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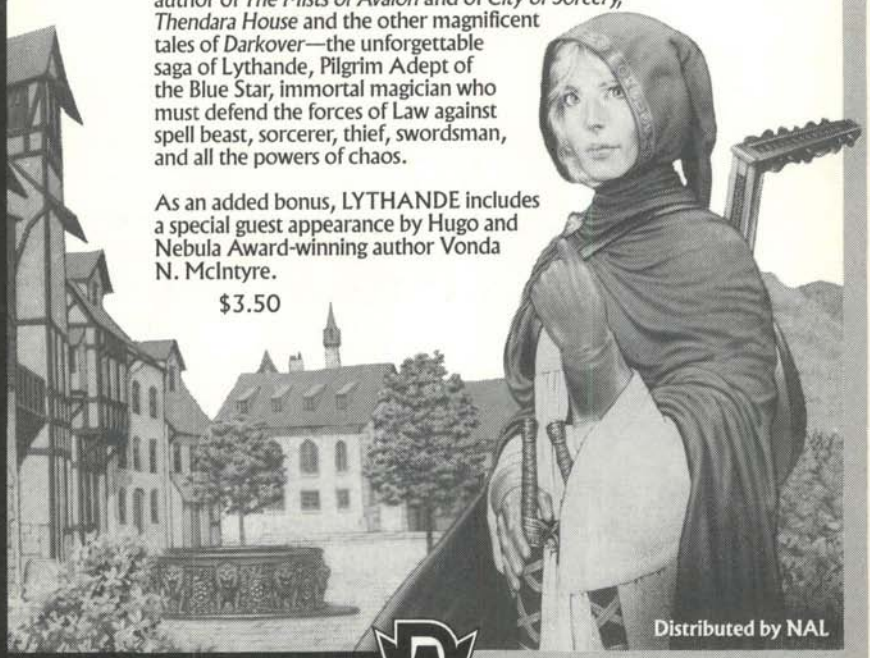

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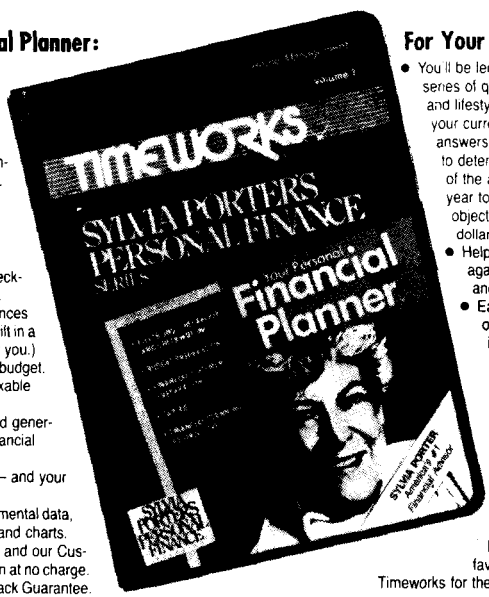

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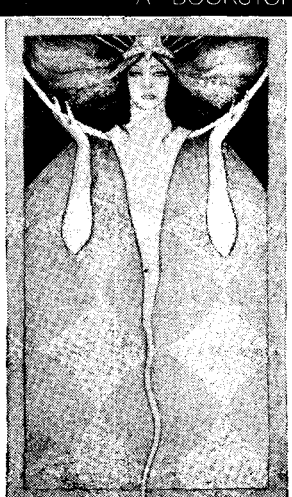

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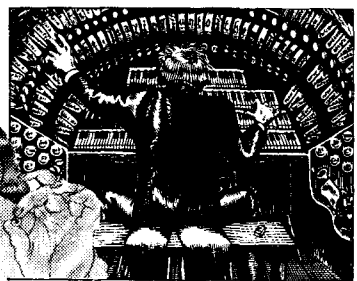

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Editorial

AFTER THE SHOCK

Stanley Schmidt

I'm writing this a couple of weeks after the space shuttle *Challenger* exploded shortly after takeoff. You'll be reading it several months later, and by then much will have happened. I can only guess what, but I must try to anticipate and think about some of the possibilities.

Millions of people were watching, some from the beaches and many more via television. The immediate emotional impact on the public seemed more widespread and intense than that of any single event since the Kennedy assassination in 1963. It included shock, horror, sympathy, anger, and incredulity—as if it had previously been inconceivable that such a thing could happen.

But, of course, it wasn't inconceivable at all. It was inevitable, sooner or later, and many people had said so. G. Harry Stine had devoted an Alternate View column to that fact and its implications in our August 1983 issue, and it was from him that I first heard the news that it had actually happened. "It's a bad day for the space program," he said, and I feared he was right.

Viewed objectively, the catastrophic loss of a space shuttle has no more intrinsic importance than that of any other

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expensive vehicle carrying a like number of passengers. But people do not view such things objectively, and the consequences of how they *do* view them could be very far-reaching indeed. Harry's concern in "The Sky is Going to Fall" was that anti-space elements in the news media would seize on such an event as the focus of a campaign to destroy the manned space program. If they succeeded, that could be a disaster of truly unprecedented proportions, because the future of our entire species may, quite literally, hang on the future of the space program. Not only do we need things from the rest of the Solar System to maintain and improve the human standard of living, but planets, like shuttles, can suffer disasters. It's not as easy to *totally* destroy a planet as a tiny spacecraft, but massive extinctions are a matter of historical record, many times over. It's only a matter of time until it happens again, and if we don't want to be part of it, we'd better take any chance we have to make sure we're not all sitting on one target.

That means a strong, well established, ongoing program of human exploration and colonization of space. There are no alternatives.

So far, the reactions of press and public have not been as Harry feared—but the danger is not past. If anything, much of what has been said so far has been of the opposite sort: praise for the heroism of the seven who died, and renewed resolve to press on with what they were doing so they won't have died in vain. But will this last? It is, after all, the sort of thing one would expect to hear this close to the event. To speak otherwise, to say *now* the things Harry warned against in his column two and a half years ago, would be akin to going to a funeral and interrupting the eulogy with loud remarks about how stupid the deceased was to get himself killed in the first place. It just isn't done in polite society.

But after he's decently buried, and a few months have gone by . . .

Even as I write, there have already been hints of less reverent reactions to come. I can hope that these will have only beneficial effects such as a determined effort to prevent the recurrence of whatever mistakes caused the *Challenger* accident. But I can't assume it. Less than one day after the accident, I heard the rumblings of revived debate over whether manned space flight should be continued in view of its costs and risks. Personally, I've heard this debate so often before, and I find the long-term need for manned space flight so compelling and the case for abandoning it (especially because of a single accident!) so weak, that I wish this argument would just go away so we can get on with doing what needs to be done. But of course it won't.

The reactions to *Challenger* have included one element that I find a little surprising and, when I think about it, more than a little disturbing: an implicit or explicit distinction between "them" and "us." On one hand there is a widespread fascination with schoolteacher Christa McAuliffe as the first "ordinary citizen" in space, leading in much coverage to a disproportionate emphasis on *her* tragedy and relative neglect of the rest of the crew. On the other hand, I've

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heard anger expressed about the alleged folly of sending "civilians" and "amateurs" into space. That seems to have two aspects: the belief that the schoolteacher was taking up space which should have been occupied by a scientist working as such, and the implication that she was somehow conned into going on an extremely dangerous mission without being made adequately aware of the risks.

To all this I have several reactions. First, Christa McAuliffe was no "ordinary" person, any more than any of the others. (From my own experience as a teacher, I suspect there *are* no "ordinary" people—just people whom you or I haven't learned to know well enough to see how they're special.) There is no need to single her out as different from the rest of the crew, as either more or less important in her role than they were in theirs. Every one of them was simply a human being (though

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admittedly well above average in intelligence, courage, and dedication) taking part in what is essentially a *human* endeavor, not the special property of a special agency. We're all in this together, for the ultimate benefit of all of us, even though—so far—only a few can actually go into space. The distinction between those who have devoted their whole careers to this effort, and those for whom it is just a part of something else, is minor and should not be exaggerated.

Second, Christa McAuliffe was no innocent dupe, and the suggestion that she didn't know what she was getting into is (I hope unwittingly) insulting to her memory. She knew perfectly well what she was doing. Nobody went through the training program she did without learning about the risks. She took those risks willingly, because the rewards seemed worth them. I would certainly oppose any attempt to make "civilians" ride shuttles against their will or without proper training. But denying them the opportunity just because they're "civilians," if they want it and know what's involved, is an entirely different matter.

Third, space is no more the exclusive province of scientists than it is of NASA's professional astronauts. Flying freight and doing experiments are not the only worthwhile things to be done in space—and that leads me to the one respect I see in which there really *was* something very special and uniquely important about Christa McAuliffe.

And why this was an especially bad shuttle to lose.

Christa McAuliffe had an important job to do. Teachers often don't realize how profound and far-reaching their influence can be, at least partly because their students would seldom admit it (and might not realize it themselves until years later). But bad ones not infrequently leave lifelong scars, and good ones may favorably change the course of whole lives. I think Mrs. McAuliffe understood this, and realized the opportunity and the responsibility her "Lessons from Space" represented. She would have had perhaps the largest "class" in history, and she would have had an unprecedented chance to help them understand, more vividly than ever before, the realities of life in space and the potential it holds for the future of humanity. The future of man in space, on which may depend the future of man *period*, will be shaped to a very significant extent by the beliefs and attitudes of Mrs. McAuliffe's distant students, a few years from now when they are voting and working and campaigning.

She hoped to show them an inspiring view of space and what it's good for. Had she succeeded, a generation that felt good about space could do a tremendous amount to make sure its potentials were realized. But she didn't have time to do that. Instead, those millions of students, vicariously sharing the exhilaration of the launch with someone they knew, saw it transformed in a literal flash into unanticipated and seemingly pointless death and destruction.

And Mrs. McAuliffe *was* someone they knew. The vast majority of them had never met her or talked with her, face to face, but those things are neither

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necessary nor sufficient to know a person. What matters is that, in anticipation of the launch and the lessons from space, they had followed her through training, had seen her face and heard her voice and been told so much about her that for them she had become a real person, not just a name in the papers. And so, for the same reasons they could feel her excitement, they could feel her loss at a very personal level.

The future of the manned space program, and quite possibly the future of man as a species, are still going to depend on how those students feel about man in space—and that's going to depend on how they deal with this incident and what kind of emotional aftertaste it leaves. If the whole thing leaves them with the feeling that it was all just a cruel joke, and the exploration of space an expensive waste of lives, their bitterness could cause the whole effort to shrivel and die. If they view it instead as just one of the setbacks and losses that inevitably occur as a part of any big new venture, they may yet salvage their determination to finish the job and make sure those lives were *not* wasted.

Which way they go will not be determined by them alone. The day it happened, you saw some of them sitting, stunned, looking at the television screen and then around them to see how others were reacting to an event for which they were so unprepared that they weren't sure how to react to it themselves. How they ultimately feel about what happened and what it should mean for the future is very subject to influence by how they see their elders handling it.

So I have a plea for all adults who have any contact with preschool or school children of any age: if you've ever tried to think, rather than just feel, your way through a situation, do it now. What happened to *Challenger* was a frightening, traumatic experience for millions of young people who saw it. There's an awful lot riding on their ability to accept that in a rational way, to keep it in perspective, and to keep the courage to go forward, creating rather than destroying hope. Whether they admit it or not, they'll be looking to you for an example of how it's done. Don't let them down.

I also have a few words for those young people themselves: Some of the adults around you will be unable to do what I hope they will—so you'll have to do it for them. Don't let the embittered and pessimistic drag you down. What happened to Mrs. McAuliffe and her crewmates was indeed a sad and shocking thing—but it was *not* the end of the world. Don't let any adult who has lost hope and nerve convince you it was. You and those who come after you are going to need space, and it's up to you to get us out there. You can do it. It won't be easy and it won't be free; worthwhile things seldom are. There will be other accidents, other setbacks, other deaths. That has always been true of any big adventure in new territory. You can't make a new thing safe and reliable until you learn how by making your best efforts *before* you know all the tricks—and you will, sadly but inevitably, make some mistakes along the way. That's how you learn, and there's always risk in learning. But it's worth it, and fortunately there have always

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been people like the *Challenger* crew who knew about the risk and didn't let it stop them. That's what you need to do, too.

An hour after the *Challenger* exploded I heard about a little girl who had seen it on television. She turned to her father and said, "Now I can never be what I wanted to be: an astronaut."

My message to her and others like her is very simple: Yes, you can. And you mustn't let anybody stop you.

Meanwhile, the Teacher in Space program will go on. A little while before I started writing this, it was announced that another teacher, Barbara Morgan, has already agreed to try again to do what Christa McAuliffe set out to do. I'm not sure when that will happen, but I'm guessing it will be after this appears. So I'll speak in future tense, and suggest that when Mrs. Morgan flies, you remember Christa McAuliffe, but look forward more than back. Wish Barbara Morgan good luck, and when she gets up there, listen carefully to what she has to say. It may be the most important lesson you'll ever hear.

Finally, for Barbara Morgan herself, I have the briefest possible message. Have a great trip! ■

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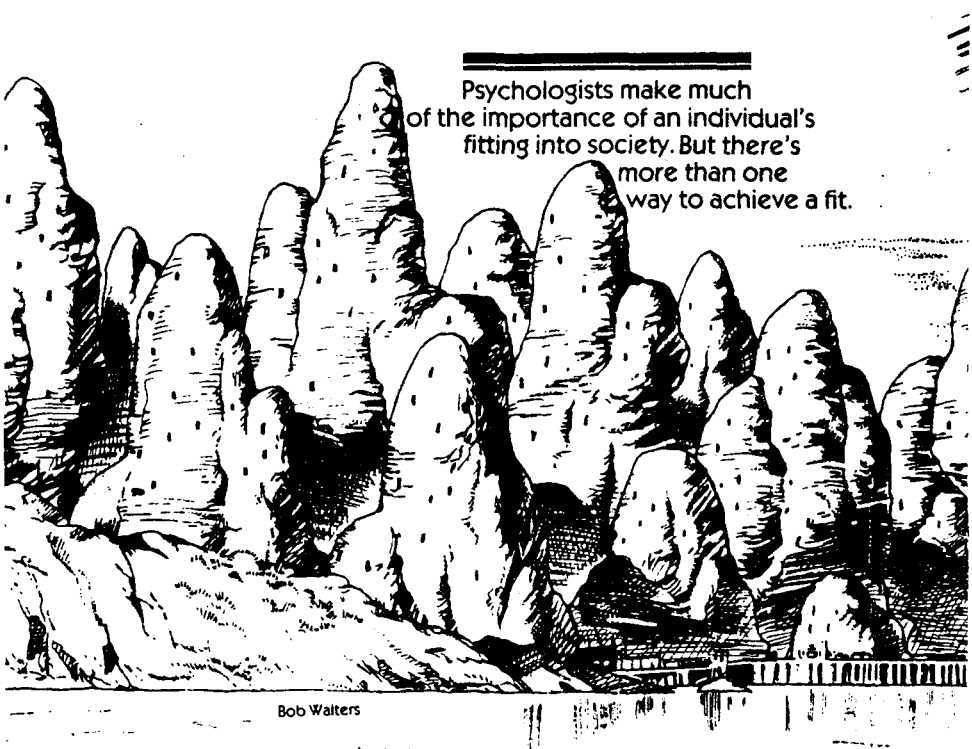
THE BARBARIAN PRINCESS


Psychologists make much of the importance of an individual's fitting into society. But there's more than one way to achieve a fit.
Bob Walters

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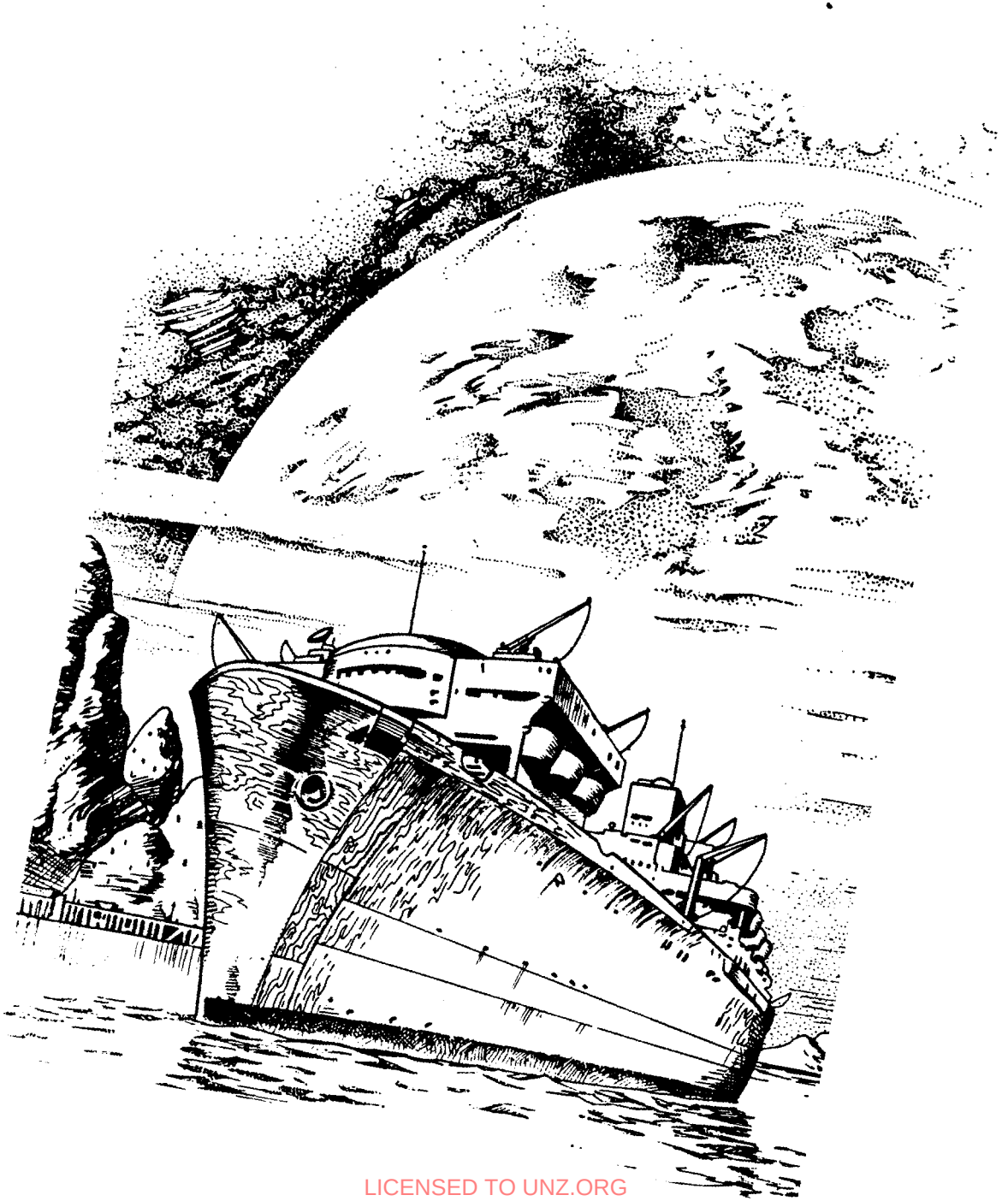

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Fair Haven at South Cape was a squalid little town. Ramshackle warehouses lined the harbor, their wooden sides unpainted and rotting. Inland, the principal cultural attractions were a couple of brothels and the barracks of the Crown garrison. Yet in one sense Fair Haven lived up to its name. No matter how scruffy things were here, you knew they would be worse farther east. This was the nether end of civilization. Beyond South Cape lay four thousand miles of wild coast, the haunt of littoral pirates and barbarian tribes.

Rey Guille would soon sail east, but the prospect did not bother him. In fact, he rather looked forward to it. For obvious reasons, there weren't many customers along the south coast run. The Tarulle Barge would put in at two of the larger barbarian settlements, villages with a taste for some of Tarulle's kinkier publications. There was also an author living in the coastal wilderness. His production was weird and erratic—but worth an extra stop. Except for these three landfalls, the Barge would sail straight around the south coast, free of external problems. It would be thirty days before they reached the Osterlais.

Thirty days, sixty wake periods. Enough time for the translators to prepare the Osterlai and Tsanart editions, enough time for Brailly Tounse to recondition the Tarulle printers. Rey surveyed his tiny office. Thirty days. That might even be enough for him to dispose of his current backlog: Manuscripts were stacked from floor to ceiling behind him. The piles on his desk blocked his view of Fair Haven harbor—and more important, the breeze that seeped in from over the water. These were all the submissions taken aboard during their passage through the Chainpearls and Crownesse. There would be some first class stories here, but most would end up as extra slush in Brailly's papermaking vats. (Thus—as Rey had once pointed out in an editorial—every submission to *Fantasie* eventually became part of the magazine.)

Rey jammed the tiny windows open, and arranged his chair so he could sit in the breeze. He was about halfway through the desk stack: The easy ones he could decide in a matter of seconds. Even for these, he made a brief note in the submission log. Two years from now the Tarulle Publishing Company would be back in the Chainpearls. He couldn't return the manuscripts, but at least he could say something appropriate to the submitters. Other stories were harder to judge: competent but flawed, or inappropriate outside the author's home islands. Over the last few days, a small pile of high priority items had accumulated beneath his desk. He would end up buying most of those. *Some* were treasures. Ivam Alecque's planet yarns were based on the latest research in spectrometry; Rey planned a companion editorial about the marvelous new science.

Alas, he must also buy stories that did not thrill him. *Fantasie* magazine lived up to its name: most of his purchases were stories of magic and mysticism. Even these were fun when the authors could be persuaded to play by internally consistent rules.

Rey grabbed the next manuscript, and scowled. Then there were the truly revolting things he must buy, things like this: another Hrala adventure. The series

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had started twenty years earlier, five years before he signed on with Tarulle. The first few stories weren't bad, if you liked nonstop illogical action with lots of blood and sex; old Chem Trinos wasn't a bad writer. As was Tarulle custom, Trinos had exclusive control of his series for eight years. Then Tarulle accepted Hrala stories from anyone. The fad kept growing. Otherwise decent writers began wasting their time writing new Hrala stories. Nowadays the series was popular all around the world, and practically a cult in the Llerenitos.

Hrala the Barbarian Princess: over six feet tall, fantastically built, unbelievably strong and crafty and vengeful and libidinous. Her adventures took place in the vast inland of The Continent, where empires and wars had no need to conform to the humdrum world that readers knew. She was the idol of thousands of foolish male readers and a model for thousands of female ones.

Rey paged slowly through this latest contribution to the legend. Hmph . . . for its kind, the story was well written. He'd have his assistant editor look it over, make it consistent with the background files she kept on the series. He would probably have to buy it. He tossed the mansucript under his desk and made a note in the submission log.

An hour later, Rey was still at it, the in-pile fractionally smaller. From the decks below his windows there was the continuing noise of supplies being loaded, crewman shouting at stevadores. Occasionally he heard people working on the rigging above him. He had long since learned to tune out such. But now there was a different clatter: someone was coming along the catwalk to his office. A moment later, Coronadas Ascuasenya stuck her head in the doorway. "Boss, such a deal I got for you!"

Uh-oh. When Cor's accent thickened and her words came fast, it was a sure sign she had been swept away by some new enthusiasm. He waved her into the office. "What's that?"

"Tarulle magazines, they don't sell themselves. Other things we need to grab buyer interest."

Rey nodded. Jespen Tarulle had a small circus housed on the after decks. They put on shows at the larger ports, hyped all the Tarulle publications. Cor was fascinated by the operation; she was constantly trying to add acts representing stories and authors from *Fantasie*. She was good at it, too, a natural born publicist. Rey figured it was only a matter of time before higher-ups noticed, and he lost his assistant editor. "What have you got?"

"Who," she corrected him. She stepped back and waved at someone beyond the doorway. "I present to you *Hrala*, Princess of the Interior!" She pronounced the name correctly, with a throat-tearing rasp that was painful even to hear.

The portentous intro brought no immediate action. After a moment, Cor stepped to the door and spoke coaxingly. There were at least two people out there, one of them a printsman from Brailly's crew. A second passed, and someone tall and lanky bent through the doorway. . . .

Rey rocked back in his chair, his eyes widening. The visitor was remarkable —though not in the way Cor meant. It was a female: there was a slimness in

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the shoulders, and a slight broadening in the hips. And she was *tall*. The ceiling of Guille's office was six feet high; the girl's tangled red hair brushed against it. But scale her down to normal size and she might be taken for a street waif. Her face and hair were grimy. A bruise darkened her face around one eye. With her arrival, the room was filled with the smell of rancid grease. He looked at her clothes and understood the source of part of the smell. She was dressed in rags. There were patches on patches on patches, yet holes still showed through. But these were not the rags of a street waif: these were leather, thick and poorly cured. She carried a walking staff almost as tall as she was.

The circus people might have use for such a character, though scarcely as Hrala. He smiled at the girl, "What's your name?"

Her only reply was a shy smile that revealed even, healthy teeth. There was a nice face hiding under all the dirt.

Cor said, "She doesn't understand one word of Spräk, Boss." She looked out the door. "What did she call herself, Jimi?"

The printsman stuck his head into the office; there wasn't room for three visitors. "Good afternoon, Master Guille," he said to Rey. "Uh, it's hard to pronounce. The closest thing in a civilized name would be 'Tatja Grimm.' " The girl's head came up and her smile broadened.

"Hmm. Where did you find her?"

"Strangest thing, sir. We were on a wood detail for Master Tounse, a few miles south of here. Just about noon we came across her on the tableland. She had that there walking stick stuck in the ground. It looked like she was praying to it or something—she had her face down near the end of the stick's shadow. We couldn't see quite what all she was doing; we were busy cutting trees. But some boys from the town came by, started hassling her. We chased them off before they could do anything."

"And she was eager to stay with you?"

"She was when she saw we were from the Barge. One of our crew speaks a little Hurdic, sir. Near as he can tell, she walked here from the center of The Continent."

Three thousand miles, through lands which—until very recently—had swallowed up every expedition. Rey cast a look of quiet incredulity at his assistant. Cor gave a little shrug, as if to say, *Hey, it will make great copy.*

The printsman missed this byplay. "We couldn't figure out quite *why* she made the trip, though. Something about finding people to talk to."

Rey chuckled. "Well, if Hurdic is her only language, she certainly came to the wrong place." He looked at the girl. During the conversation, her eyes had wandered all about the office. The smile had not left her face. Everything fascinated her: the carved wall panels, the waist-high stacks of manuscripts, Guille's telescope in the corner. Only when she looked at Rey or Cor or Jimi did her smile falter and the shyness return. *Damn.* Didn't Cor realize what she had here? Aloud he said, "This is something I should think about. Jimi, why don't you take this, ah, Tatja over to the public deck. Get her something to eat."

"Yes, sir. Tatja?" He motioned her to follow him. The girl's shoulders

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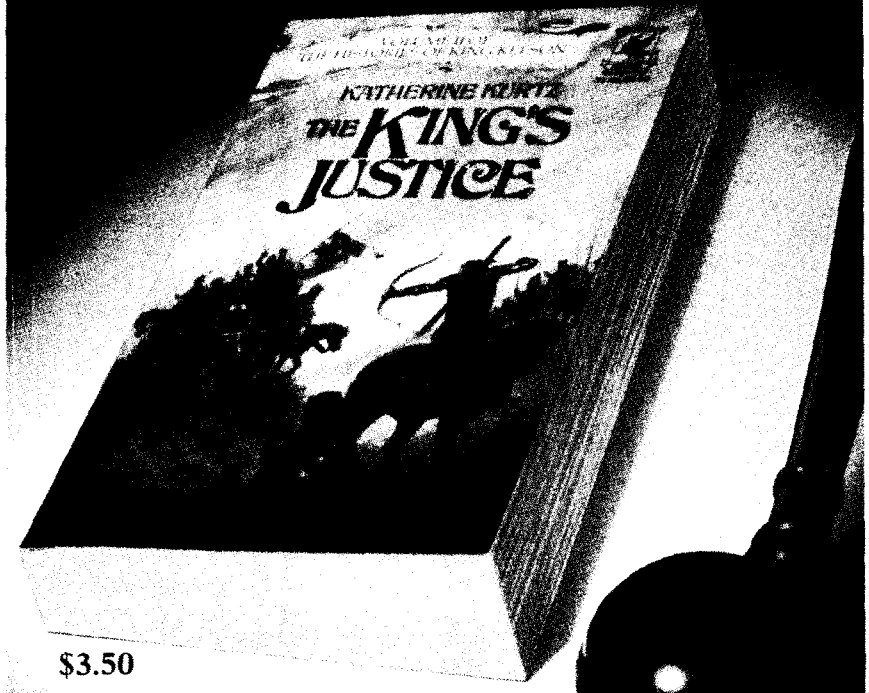

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slumped for an instant, but she departed without protest.

Cor was silent till their footsteps had faded into the general deck clamor. Then she looked at Guille. "You're not going to hire her." It was more an accusation than a question.

"You'd find her more trouble than she's worth, Cor. I'd wager she's a local girl; who ever heard of an inlander with red hair? Watching her, I could see she understood some of what we were saying. Whatever Hurdic she speaks is probably in Jimi's imagination. The poor girl is simply retarded—probably caused by the same glandular problem that's sprouted her six feet tall before she's even reached puberty. My guess is she's barely trainable."

Cor sat on one stack of manuscripts, propped her feet on another. "Sure, she's no inlander, Boss. But she's not from Fair Haven. The Haveners don't wear leather like that. She's probably been expelled from some local tribe. And yes, she's a dim brain, but who cares? No need for The Great Hrala to give big speeches in Spräk. I can teach her to strut, wave a sword, make fake Hurdic war talk. Boss, they'll love her in the Llerenitos."

"Cor! She doesn't even *look* like Hrala. The red hair—"

"Wigs. We got lotsa nice black wigs."

"—and her figure. She just doesn't have, uh . . ." Guille made vague motions with his hands.

"No tits? Yes, that's a problem." The "true" Hrala danced through her adventures wearing next to nothing. "But we can fix. The vice magazine people have props. Take one of their rubber busts and wrap it in brassiere armor like Hrala wears—it'll fool an audience." She paused. "Boss. I can make this work. Tatja may be dim, but she wants to please. She doesn't have any place else to go."

Guille knew this last was not part of the sales pitch; Ascuasenya had a soft streak undermining her pragmatism. He turned to look out at Fair Haven. A steady stream of supply lighters moved back and forth between the town's main pier and the deeper water surrounding the Barge. Tarulle was due to lift anchor tomorrow noon. It would be two years before they returned to this part of the world. Finally he said, "Your scheme could cause real problems the next time we visit this dump. Come the night wake period, go into town and look up the Crown's magistrate. Make sure we're not stealing some citizen's kid."

"Sure." Cor grinned broadly. Victory was at hand. Guille grumbled for a few more minutes: Hiring an actress would mean going up the chain of command to Overeditor Ramsey, and perhaps beyond him to the Tarulles. That could take days, and much debate. Guille allowed himself to be persuaded to hire the girl as an apprentice proofreader. The move had a certain piquancy: how many writers had accused him of employing illiterate nitwits as proofreaders?

Finally, he reminded his assistant editor that she still had a full-time job preparing the issues that would sell in the Osterlais. Cor nodded, her face very serious; the Hrala project would be on her own time. He almost thought he'd intimidated her—until she turned to

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leave and he heard a poorly suppressed laugh.

It took Cor less than two days to realize what a jam she had talked herself into. The Barge was back at sea and there were no distractions from shorefolk, but now she found herself working thirty hours a day, setting up the Hrala rehearsals with publicity, looking after the Grimm girl, and—most of all —getting *Fantasie* into shape.

There were *so* many manuscripts to review. There were good stories in the slush pile, but more science-oriented ones than ever before. These were Rey Guille's special favorites, and sometimes he went overboard with them. *Fantasie* had been published for seven hundred years. A certain percentage of its stories had always claimed to be possible. But only in the last fifty years, with the rise of science, could the reader feel that there was a future where the stories might really happen. Rey Guille had been editor of *Fantasie* for fifteen years. During that time, they had published more stories of Contrivance Fiction than in all the previous years. He had Svektr Ramsey's permission to include two in every issue. More and more, he found readers whose only interest was in such stories. More and more, he found readers who were creating the science that future stories would be based on.

Cor knew that, in his heart, Rey saw these stories as agents of change in themselves. Take the spectrometry series: during the last five years, he had written a dozen editorials advertising the new science ("Spectrometry, Key to Nature's Secrets"), and soliciting stories based on the contrivance. Now he got one or two new ones at every major stop. Some of them were salable. Some were mind-boggling. . . . And some were wretched.

Ascuasenya had been working on the Barge for five quarters, and as Rey Guille's assistant for nearly a year. She had read her first *Fantasie* story when she was five. It was hard not to be in awe of the magazine's editor, even if he was a crotchety old codger. (Guille was forty-one.) Cor did her best to disguise her feelings; their editorial conferences were running battles. This morning was no different. They were up in his office, putting together the first issue for the Osterlais. The slush pile had been reduced to desk height and they had plenty of room to lay out the pieces Rey had selected for the new issue. Outside Guille's office, the bright light of morning had slowly reddened. They were well into the eclipse season; once every twenty hours, Seraph blocked the sun or was itself eclipsed. Every wake period was punctuated by darkness as deep as night on the far hemisphere. Guille had set lamps on every available hook, yet he still found it hard to read fine print.

He squinted at the Ivam Alecque manuscript Cor was complaining about. "I don't understand you, Cor. This yarn is *world-shaking*. If we didn't put anything else in the next issue, 'Pride of Iron' could carry it all."

"But the writing, it is so wooden. The characters have no life. The plot makes me sleepy."

"By the Blue Light of Seraph, Cor! It's *ideas* that make this great. 'Pride

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of Iron' is based on spectro results that aren't even in print yet."

"Phooey. There have been stories with this theme before: Ti Liso's Hidden Empire series. He had houses made of iron, streets paved with copper."

"Anyone who owns jewelry could imagine a world like that. This is different. Alecque is a chemist; he uses metals in realistic ways—like in gun barrels and heavy machinery. But even that isn't the beauty of this story. Three hundred years ago, Ti Liso was writing fantasy; Ivam Alecque is talking about something that could really *be*." Rey covered the lamps and threw open a window. Chilliness oozed into the office, ocean breeze further cooled by the eclipse. The stars spread in their thousands across the sky, blocked only by the Barge's rigging, dimmed only by mists rising from the pulper rooms below decks. Even if they had been standing outside, and could look straight up, Seraph would have been nothing more than a dim reddish ring. For the next hour, the stars ruled. "Look at that, Cor. Thousands of stars, millions beyond those we can see. They're suns like ours, and—"

"—and we buy plenty of stories with that premise."

"Not like this one. Ivam Alecque knows astronomers at Krirsarque who are hanging spectro gear on telescopes. They've drawn line spectra for lots of stars. The ones with color and absolute magnitude similar to our sun show incredibly intense lines for iron and copper and the other metals. This is the first time in history anyone has had direct insight about how things must be on planets of other stars. Houses built of iron are actually possible there."

Ascuasenya was silent for a moment. The idea was neat; in fact, it was kind of scary. Finally she said, "We're all alone in being so 'metal poor'?"

"Yes! At least among the sunlike stars these guys have looked at."

"Hmm . . . It's almost like the gods, they play a big joke on us." Cor's great love was polytheistic fantasy, stories where the fate of mortals was the whim of supernatural beings. That sort of thing had been popular in *Fantasie*'s early centuries. She knew Rey considered it out of step with what the magazine should be doing now. Sometimes she brought it up just to bug him. "Okay. I see why you want the story. Too bad it's such an ugly little thing."

She saw that her point had struck home. A bit grumpily, Rey unmasked the lamps, then sat down and picked up "Pride of Iron." It really was plotless. And—on this leg of the voyage, anyway—he was the only one capable of pumping it up. . . . She could almost see the wheels going around in his head: But it would be worth rewriting! He could have the story published before these ideas were even in the scientific literature. He looked up, grinned beligerently at her, "Well, I'm going to buy it, Cor. Assume 'anonymous collaboration' makes it twice as long: what can we do for illustrations?"

It took about fifteen minutes to decide which crew-artists would work the job; the Osterlai issue would use slightly modified stock illos. Hopefully, they could commission some truly striking pictures as they passed through that island chain.

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The rest of the Osterlai issue was easy to lay out; several of the stories were already in the Osterlai language. The issue would be mostly fantasy, the new artwork from artists of Crownesse and the Chainpearls. The cover story was a rather nice Hrala adventure.

"Speaking of Hrala," said Rey, "how is your project coming? Will your girl be able to give a show when we start peddling this issue?"

"Sure she will. We get about an hour of rehearsal every wake period. Once she understands about stage performance, things will go just fine. So far, we work on sword and shield stuff. She can memorize things as fast as we can show her. She's awful impressive, screaming around the stage with *Death* in her hand." In the stories, the Hrala Sword was magical, edged with diamonds, and so heavy that an ordinary warrior could not lift it. The Tarulle version of *Death* was made of wood painted silver.

"What about her costume?" Or lack of one.

"Great. We still gotta do changes —ribbon armor is hard to fit—but she looks tremendous. Svektr Ramsey thinks so too."

"He *saw* her?" Guille looked stricken.

"Don't worry, Boss. The Overeditor was amused. He told me to congratulate you for hiring her."

"Oh . . . Well, let's hope we're all still amused when you put her on stage with other actors."

Cor gathered up the manuscripts they had chosen. She would take them, together with the production notes, over to the art deck. "No problem. You were right, she understands some Spräk. She can even speak it a little. I think she was just shy that first day. On stage she'll mainly scream gibberish—we won't need a new script for each archipelagate." Cor carried the papers to the door. "Besides, we get the chance to put it all together before we reach the Osterlais. We arrive at the Village of the Termite People in three days; I'll have things ready by then."

Guille chuckled. The Termite People were scarcely your typical fans. "Okay. I look forward to it."

Cor stepped into the darkness, shut the hatch behind her. In fact, she was at least half as confident as she sounded. Things ought to work out, if she could just find time to coach Tatja Grimm. The giant little girl was stranger than Cor had admitted. She wasn't really dumb, just totally deprived. She'd been born in some very primitive tribe. She'd been five years old before she ever saw a tree. *Everything* she saw now was novelty. Cor remembered how the girl's eyes had widened when Cor showed her a copy of *Fantasie*, and explained how spoken words could be saved with paper and ink. She had held the magazine upside down, paged back and forth through it, fascinated by both pictures and text.

Worst of all, Tatja Grimm had no concept of polemic; she must have been an outsider even in her own tribe. She simply did not accept that dramatic skits could persuade. If Grimm could be convinced of that single point, Cor was sure the Hrala campaign would be a spectacular success. If not, they might all end up with bat dreck on their faces.

The day they were to land at the Village of the Termite People, Rey took

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the morning off. He walked around the top editorial deck, looking for a place sheltered from the wind and passersby. This would be his first chance to play with his telescope since Fair Haven.

The marvelous weather still held. The sky was washed clean; widely spaced cumulus spread away forever. A Tarulle hydrofoil loitered about a mile ahead of the Barge, its planes raised and sails mostly reefed. Guille knew there were others out there; most of the Barge's 'foil bays were empty. The high speed boats had many uses. In civilized seas, they ranged before and behind the Barge—making landfall arrangements, carrying job orders, picking up finished illustrations and manuscripts. In the wilderness east of Fair Haven, they had a different role: security. No pirates were going to sneak up on the Barge. The rockets and catapults and petroleum bombs would be ready long before any hostile vessel broke the horizon.

So far, all the traffic was friendly. Several times a day they met ships and barges coming from the east. Most were merchantmen. Only a few publishing companies had Tarulle's worldwide scope. The hydrofoils reported that the *Science* was docked at the Village of the Termite People. That ship was much smaller than the Tarulle Barge, but it published its own journal. It was sponsored by universities in the Tsanarts as a sort of mobile research station. Rey looked forward to spending a few hours on the other vessel. It would mean some sales, and would give him a chance to make contacts; these were people who appreciated the new things he was doing with *Fantasie*. Notwithstanding Cor's Hrala project, seeing the *Science* would be the high point of this landfall.

Guille rolled the telescope cart into an open area at the rear of the editorial deck. Here the breeze was blocked by Old Jespen's penthouse, yet there was still a reasonable view. He clamped the cart's wheels and leveled its platform. Back in the Chainpearls—just after he bought the scope—this operation would have attracted a small crowd and begun an impromptu star- or Seraph-party. Now, passersby said hello, but few stopped for long. Rey had his toy all to himself.

He flipped the tube down and took a scan across the northern horizon. They were about fifteen miles off the coast. To the naked eye, The Continent was a dark line at the bottom of the sky. The telescope brought detail: Guille could see individual rocks on the dun cliffs. Trees growing in the lee of the hills were clearly visible. Here and there were rounded lumps he recognized as wild termite towers. The Village was hidden beyond a small cape.

Not a very impressive coast for the greatest landmass in the world. Beyond those cliffs, the land stretched more than ten thousand miles northward—over the north pole and partway down the other side of the planet. There was a hundred times more land there than in all the island chains put together. It was an ocean of land, and beyond its coastal fringe, mostly unknown. No wonder it had been the source of so many stories. Rey sighed. He didn't begrudge those stories. In past centuries, speculation about the Interior was a decent story base. The island civilizations weren't more than a couple of thousand years old—the human race must have originated on The Continent. It was reason-

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able that older, wiser civilizations lay in the Interior. Whole races of monsters and godlings might flourish in those reaches.

But during the last thirty years, there had been serious exploration. In the last ten years, three separate expeditions had trekked across the Interior. The unknown remained, but it had been cut into small hunks. The myths were dead and the new reality was a dismal thing: An "ocean" of land is necessarily a very dry place. Beyond the coastal fringe the explorers found desert. In that, there was variety. There were deserts of sand and heat, deserts of rock, and—in the north—deserts of ice and cold. There was no hidden paradise. The nearest things to the "Great Lakes" of legend were saline ponds near Continent's Center. The explorers found that the Interior *was* inhabited, but not by an Elder Race. There were isolated tribes in the mid-latitude deserts. These folk lived naked, almost like animals. Their only tools were spears and hand axes. They seemed peaceful, too poor even for warfare. The lowest barbarians of the Fringe were high civilization compared to them. And all these years, the story writers had assumed that the Hurdic tribes were degenerate relatives of Interior races!

Yet Interior fantasies were still written. Guille saw hundreds of them a year—and worse—had to buy dozens. Ah well. It was a living, and it gave him a chance to show people more important things. Rey stepped back from the telescope, and turned its tube almost straight up. It was Seraph he really wanted to look at.

"Hel-lo?"

Rey looked up, startled. He had an audience. It was the Fair Haven waif. She stood almost behind him and about ten feet away. He had the feeling she'd been watching for several minutes. "Hello indeed. And how are you today, Mistress Grimm?"

"Good." She smiled shyly and took a step forward. She certainly looked better than when he first saw her. Her face was scrubbed clean. In place of rancid leather, she wore crew fatigues. If she had been five feet tall instead of six, she would have seemed a pretty preteener.

"Shouldn't you be rehearsing with Cor?"

"I, uh, that is la-ter."

"I see. You're off duty."

She bobbed her head, seeming to understand the term. Somehow, Rey had imagined that Cor or the publicity people would be looking after Tatja all the time. In fact, no matter how incompetent she was, there simply were not enough people to babysit her. The girl must have many hours to herself; no doubt she wandered all over the Barge. By the Light, the trouble she could get into!

They stared at each other for a moment. The girl seemed so attentive, almost in awe of him. He realized she wouldn't leave unless he explicitly told her to get lost. He tried to think of an appropriate dismissal, but nothing came. Damn. Finally he said, "Well, how do you like my new telescope?"

"Good. Good." The girl stepped almost close enough to touch the scope, and Rey went through the usual explanations: He showed her how the wheels could be fastened to the deck. The oil

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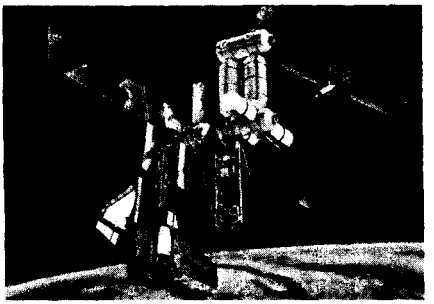

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bath in the cart's base damped the sea motion and kept the optics steady. The cart itself was an old drafting rig from the art deck. Rey had removed the drawing table and substituted clamps that attached to the base of his twelve-inch scope.

Tatja Grimm didn't say much, but her enthusiasm was obvious. She leaned close to the equipment to see the details Rey pointed out. When he explained something, she would pause for an instant and then bob her head and say, "Yes. So nice."

Guille wondered if he could have been wrong about her. In some ways, she seemed a more thoughtful and enthusiastic audience than crew people he had shown the gear to. But then he noticed the uniformity of her responses. Everything seemed to impress her equally. Every explanation took the same brief moment for her to absorb. Guille had a retarded cousin, mental age around five years, physical age thirty: after so much living, a retarded person learns to mimic the head movements and nonsense sounds that normal people make in conversation. Rey could imagine the blank look he would get if he asked Tatja something related to his explanations.

He didn't try such an experiment. What point was there in hurting the girl's feelings? Besides, she seemed to enjoy the conversation as much as a normal person. He aimed the scope at Seraph as he continued his spiel. The planet was in quarter phase, and the mountains of its southern continent stood in stark relief near the terminator. Wind and ship vibration jostled the image a bit. On the other hand, the line of sight was straight up, without lots of dirty air to smudge things. This was the clearest day-view he'd ever had. ". . . so my telescope makes objects seem much closer. Would you like to look?" Even a retard should be thrilled by the sight.

"Yes." She stepped forward, and he showed her how to use the eyepiece. She bent to it . . . and gave a squeal, a wonderful mixture of pleasure and surprise. Her head jerked back from the eyepiece. She stared upward at the twin planet, as if to assure herself that it hadn't moved. Just as quickly she took another look through the lense, and then backed off again. "So big. So *big!*" Her smile all but split her face. "How can te-le-scope—" she reached up, as if to jerk the tube's end down to eye level.

Guille caught her hands. "Oops. Be gentle. Turn it around this pivot." She wasn't listening, but she let him rotate the tube so she could look in. Her eyes went wide as she saw the expanded image of her face in the main mirror. Rey found himself explaining about "curved mirrors" and how the diagonal directed the image from the 12-inch through the eyepiece. The girl hesitated the same fraction of a second she had after his other explanations. Then—just as before—her head bobbed with an enthusiastic imitation of total understanding. "Yes. Yes. So nice."

Abruptly, she grabbed Rey's hand. "And you think this thing? You make it?"

Tatja's grip was almost painful; her hands were slender but as outsized as the rest of her. "You mean, did I invent the telescope?" He chuckled. "No,

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Miss Grimm. The basic idea is two hundred years old. People don't invent telescopes just to pass the time on a dull morning. Things like this are the work of scattered geniuses. Part of an invention may exist for decades, useless, before another genius makes the idea successful."

The girl's expression collapsed. It might have been laughable if it weren't so pathetic. She had no concept of what was difficult and what was trivial, and so her attempt at bright conversation had foundered. Rey turned her gently back to the telescope and showed her how to adjust the focus. Her former enthusiasm did not completely return, but she seemed sincerely taken by the close-up view of Seraph. Rey gave her his usual spiel, pointing out the brown smudges across part of the southern continent. "Brush fires, we think. That land must be a lot like the grassy plains north of Bayfast. The religions have all sorts of visions of Seraph, but we now know it's a world much like ours." And the stories of hidden civilizations *there* might still be true. Rey had written more than one editorial about plans for detecting and communicating with Seraph's hypothetical inhabitants. One of the first steps would be to build an observatory in this part of the world, where Seraph could be observed with a minimum of atmospheric distortion.

A couple of people from Printing had stopped nearby, were watching intently. They were not the sort Rey would think attracted by skygazing; one was Brailly Tounse's bombwright. Rey glanced at her questioningly.

"Sir, we've got a line of sight into the harbor now," the bombwright waved to the north. "We were wondering if you'd take a quick look at Termite Town through your scope."

Rey hid a sigh, and gave up any hope of having the device to himself this morning. The bombwright must have noticed his irritation. She hurried on to say, "Something strange is happening with the Termite People, sir. So far the officer types ain't talking, but—take a look, will you?"

Guille eased Tatja Grimm away from the scope and tilted it toward the horizon. He made a quick adjustment with the spotter scope and then looked through the main eyepiece. ". . . Looks about like I remember it." There were dozens of towers, from water's edge back up the hills around the harbor. The smallest ones were bigger than a house. The largest were over a hundred feet tall. The spaces between were like streets at the bottom of shadowed canyons. Even knowing the truth, one's first reaction was awe: this must be a city, the greatest in the world. Krirsarque and Bayfast were insignificant, low-story affairs compared to this. In fact, there were only a few thousand humans in this whole "city." They dug their burrows and staircases through the termite mounds; they poked air holes through the walls, holes that also served as windows. "Hmm. There's something different. One of the towers by the moorage . . . it looks like it was burned, or stained with soot. The dark goes as high as the windows overhanging the water."

"Yes, sir. That's what got our attention, but we couldn't see what made the stain. And there's something strange in the water, too."

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Rey tilted the scope a fraction. A twisted pile of spikes and filaments stuck through the water, directly in front of the scorch-marked tower. Rey sucked in a breath. "It looks like ship's rigging, the fiber glass part."

The bombwright stepped close, and he let her take a look. She was silent for a moment, then, "Unh huh. That's where they like visitors to dock. Looks like the gooks dumped pet' bombs out those windows, right onto the moorage. The guys they ambushed didn't have a chance."

A minute before, Rey had been feeling sorry for one retarded girl. Now . . . He looked across the water. Without a telescope, the Village was a barely distinguishable skyline, the scorch unnoticeable.

The guys they ambushed . . . According to the advance reports, there had been exactly one ship tied up at the Village: the *Science*.

Crew and publishing folk spent the next few hours speculating: Why was the *Science* ambushed? What would Tarulle do about it? The Barge stayed several miles offshore, but rumor held that hydrofoils were doing close recon under cover of the midday eclipse. The only word from the penthouse deck was that there would be no immediate landing.

Top management was not asleep—just terribly indecisive. Rey Guille bluffed his way onto the bridge shortly before eclipsend. All the Biggies were there, from both Ownership and Operations. The atmosphere was that of an incipient brawl: consensus time had not arrived.

"—and I say, sail into catapult range and burn their filthy village to the ground! Barbarians must learn that ambushing merchants is a dangerous sport." The speaker was one of Tarulle's nephews, an arrogant pipsqueak who'd be scrubbing decks if it weren't for his relatives. The little man looked angrily around the room, daring anyone to disagree. Fortunately for the Company, there were some strong personalities present:

Barge Captain Maccioso stood near the helm, facing the rest. His form was a vague, intimidating shadow in the eclipse light. Maccioso was a huge man; the bridge itself had been rebuilt to accomodate his six feet eight inch height. He was in his early fifties and only just beginning to go to fat. The first twenty years of his career had been spent in the Chainpearls Navy. The man had retired an admiral, and the greatest hero of the Loretto Bight affair. Now he crossed his hamlike arms and seemed to lean toward Tarulle's nephew. "Warlike talk coming from . . ." *a wee wimp who couldn't cock a bow*, the pause seemed to say, "from those who need customers to live. It's true, I could torch the Village. It would be expensive; we wouldn't be left with much reserve. And what would we get for it? The Termite Folk are isolated, Master Craeto. There would be few to learn from the lesson. The Tarulle Company would lose one—admittedly minor—customer. The Barge has visited here four times since I've been Captain. We've had less trouble than in some civilized ports. These people are not pirates. The *Science* crew did something, broke some taboo—"

Maccioso turned to looked into the harbor; sunbreak was almost upon them.

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The land was bright with washed-out pastels. When he continued, his voice held more frustration than certainty. "Sure. We have the power to raze the place. But we could never bring off an assault landing. There's no way we can rescue the survivors and find out how to avoid such a debacle in the future."

Survivors? Someone had lived through the pet' bombing. Rey felt a surge of joy. No one else seemed moved by the news; they already knew. This must be a major point of the debate. "We can't just leave them there!" The words popped out of Guille's mouth without conscious thought.

Dead silence greeted his words. The people closest to him moved slightly away, but didn't look at him; it was as though he had made a bad smell. Maccioso turned and his gaze swept the bridge. "Master Tounse!"

"*Sir!*"

The Barge Captain pointed at Rey Guille. "Take this man out and . . ." Rey's guts went cold; there were stories about Ked Maccioso's command of the Chainpearl Armada, "*brief* him."

"Yessir!"

Brailly Tounse emerged from the crowd and hustled Rey onto the open walkway beyond the bridge. The Printmaster shut the hatch and turned to face him. " 'Brief you'? The commercial life is turning Ked soft." It took a moment for Rey to realize that the other man was suppressing laughter. "Don't you understand that a rescue is what Ked is dying to do? For almost an hour, he's been trying to trick these flightless bats into backing one."

"Oh." Rey was both embarrassed and encouraged. "Maybe my, uh, little outburst will start something."

"I hope so." Brailly stopped smiling. "But even by Ked's standards, it would be a risky operation pulling those *Science* people out."

He led Rey to the forward end of the walkway. All around them, twilight brightened suddenly into day as the sun came past the edge of Seraph. Swarms of daybats rose from the harbor. They swept around the towers, their cries coming clear and reedy across the water.

Brailly gestured at the bridge binoculars. "Take a look to the left of the harbor towers. That's where they're holding the survivors." It was some kind of pit, probably the root of a fallen tower. Rey saw Termite Folk camped around the edge. Tounse continued, "They're in that hole, out of sight from this angle. See how the locals have set petroleum vats along the edge? They could light and dump those in a matter of minutes—"

—incinerating the prisoners. The Tarulle people would have to sneak in a large party, and overpower the guards at those vats all at once. One slip and a lot of Company people would share the fate of those in the pit. "We could offer a ransom, Brailly. It might be expensive, but the *Science* home university would probably pay us back. . . . And there'd be lots of good publicity." The spinoffs from such an adventure could fill several issues of the Tarulle magazines.

"You don't understand: the *Science* people aren't hostages. The only reason they're still alive is that an appropriate method of execution hasn't been decided on. The local bosses tell us that

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no ransom will save the prisoners. They won't even tell us what 'blasphemy' the poor suckers committed. The whole matter is closed. And you know, I think the gooks actually expect to continue business as usual with the rest of us!"

"Hmm." Rey had dealt with the Village's rulers. Their interest in certain types of pulp fiction had always made them seem relatively civilized. They had not seemed religious—and now he saw that was just a sign of how damned secretive their religion must be. He stared through the binocs a moment more. Beyond the edge of that pit were some good people. "We've got to do something, Brailly."

"I know. Ked knows." The Printmaster shrugged. After a moment, the two men walked back to the command bridge. Inside, Rey saw that the tension had drained from the meeting; concensus had finally been reached. Brailly smiled sourly and whispered, "But we also know how it's going to turn out, don't we?"

Rey looked around, and with a sinking feeling he understood. The Tarulle Publishing Company had existed for seven hundred years. Few island-bound companies were that old—and yet Tarulle had been sailing the oceans of Tu all that time, contending with tempests and pirates and religionists and governments. There had been disasters; three hundred years earlier, the old Barge was burned to the waterline. Yet the Company had survived, and prospered. One doesn't last seven hundred years by rushing into everyone else's fight. The Barge and its hydrofoils were well armed, but given a choice they simply avoided trouble. If a village or even an island chain turned to religious nuttery, they lost Tarulle's business. The years would pass, and the regime would fall —or decide that it needed trade more than its crazy convictions.

Kederichi Maccioso had done his subtle best to bring another outcome, but it was not to be: the talk now was of delivering a few threats and—if that did not help the *Science* people —weighing anchor and sailing off.

There must be some way to stop this! Then he had it: Brailly said the Termite Folk wanted business as usual. For the second time in fifteen minutes, Rey interrupted the meeting. "We can't simply take off; we have magazines to sell here, and customers who want to buy."

This outburst was greeted with the same silence as before. Only this time, it was not Ked Maccioso who responded. There was a croaking sound from somewhere behind the Tarulle in-laws. The owners looked nervously at each other, then stood aside. Out of the shadows came a very old man in a wheel chair: Jespen Tarulle himself. He rolled far enough past his relatives to get a look at Rey Guille. It was only the third time Rey had seen the man. He was wrapped in blankets, his hands clasped and shivering in his lap. Only one eye tracked and it was starred with a cataract. His voice was quavery, the delivery almost addled. "Yes. These folk haven't done us harm, and our business is to *do business*." He looked in Rey's direction. "I'm glad someone still understands this."

Maccioso didn't sound quite so enthusiastic. "It's risky, sir, not your average sales landing. . . . But I could go along with it, if we can get the volun-

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teers." Volunteers who might wangle the prisoners' freedom, or at least discover their exact situation; Rey imagined the wheels turning in the Barge Captain's head.

"Sirs. I volunteer for the landing." It was Brailly Tounse, barely hiding a smile.

"I-I volunteer." The words were coming from Rey's own mouth. He mumbled the rest, almost a rationalization to himself: "I've handled sales landings here before."

Old man Tarulle tilted his head at the other owners. "Are we agreed?" It was not quite a rhetorical question; the explicit recommendation of Jespen Tarulle counted for a lot, but he was not a majority stockholder. After a moment, there came mumbled acquiesence. Tarulle looked across the desk. "Operations? Are there any objections from them?"

"I have a question." It was Svektr Ramsey. He looked at Guille. "Have you finished your work on the first Osterlai issue of *Fantasie*?"

"My assistant can handle what remains, Master Ramsey." He had just finished the rewrite of "Pride of Iron."

"Ah." A smile split the gaunt Overeditor's face. "In that case, I have no objections." And if things didn't work out, there would plenty of time to put a black border around the editorial page.

They didn't go ashore until ten hours later, in the night wake period. It had been a busy time. The landing was to look like the previous ones here. There would only be one boat, less than a dozen people. Except for Rey—who was probably known to the locals—those twelve were not the usual sorts for a commercial landing. Maccioso picked people with military and naval backgrounds. The Barge Captain had imagined many contingencies. Some involved simple gathering of information, perhaps an attempt at diplomacy; others would mean quick violence and a frantic effort to get back to sea ahead of the Termite People. From the beginning, it was agreed that no obvious weapons would be taken. Brailly Tounse produced explosive powder that could be carried in their jackets; that should pass any inspection the Termiters might make.

Though it was probably a futile contribution, Rey Guille took his telescope. It had impressed Tatja Grimm; it might have some effect on the locals. (On the other hand, such high technology might be what got the *Science* in trouble. Rey broke the scope into its components and stored them in different parts of the landing boat.)

Coronadas Ascuasenya had been furious. She wanted to take her Barbarian Princess act ashore and pretend that Tatja Grimm was *truly* Hrala. Maccioso rejected the plan—and Rey agreed with him. Ascuasenya claimed the girl had absorbed the role these last couple of days, that she was the most convincing Hrala ever produced. It really didn't matter. Rey doubted that the local rulers believed the Hrala stories. In any case, using the act to intimidate could cause the prompt massacre of both prisoners and would-be rescuers.

So Cor stayed behind, and Guille found himself on the landing boat surrounded by some very competent fight-

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ers. Except for Brailly, he knew none of them.

They were only a hundred yards from the shore. Seraph was at first quarter, and its blue light lay serene across everything. The loudest sounds were the splash of oars into water, and the occasional grunt of a rower. Beach bats and flying fish swooped low around the lighter. The smell of char and oil was stronger than the salt tang of the water. They were passing a ragged jungle of black glass—what was left of the *Science*. The bats swarmed through the twisted rigging: one creature's catastrophe is another's new home.

The termite mounds were awesome at this distance. Hundreds of airholes lined their sides. A few of the towers actually broadened with height so that they hung over the water. It was like some artist's vision of a city of the future. Even knowing what the towers really were, it was hard not to feel intimidated.

Early seafarers thought the Termite Folk were nonhuman. Alas and fortunately, the village wasn't the work of gods. The locals were normal humans, using mounds that occurred all through this region. They brought in extra materials for the termites, then guided and pruned the structures. Basically the Termite People were Hurdic folk taking advantage of local circumstance. And strangely, they had no special pride in the towers. They seemed much prouder of the heritage they imagined having lost when they left the Interior.

Brailly Tounse kicked at the crate that was their cargo. "Still don't see why the gooks are interested in *Fantasie*."

Rey shrugged. "We don't sell them the whole thing, just stories of the Interior. My guess is, they see themselves as a great people fallen on hard times. Stories about Inner Kingdoms stroke that vision. We don't sell more than a few dozen copies per visit, but they pay several coppers for each."

Tounse whistled softly. "God, if only our other customers were that eager." He turned to look at the towers. On the other hand, the Barge's usual customers bought in much larger quantities . . . and didn't incinerate visitors.

The landing boat slid up to a crude pier. Some thirty guards stood along its length, their spears held in salute. The local bosses were in a group just above the landing point. As the Tarulle people climbed from the boat, low-ranking priests came down to help carry Rey's crate. So far everything seemed normal.

The tallest of the locals advanced on Rey, and gabbled something in a singsong cadence. This was the priest they usually dealt with; the guy had an excellent reading knowledge of Spräk but little chance to speak it. His phrasing was straight out of an old-time adventure novel. After a second Rey got the avalanche of mispronounced words sorted out: "Master Guille, happy we are to see you again." The priest bowed in the direction of the magazines. "And happy we are to learn more Ancestor Truth. You and your crew are welcome in the Hall. We will examine the new truth and decide on fair payment."

Rey mumbled something appropriately pompous, and they walked toward the Village, Guille and the Termiter priests in the lead. Behind him, the landing party hung together, their tenseness obvious. This was the third time Rey

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had been here. He marveled that he had not been afraid before. In fact, the place had been a comic relief. *Then* when the locals spoke of "Ancestor Truth" it seemed a light turn of phrase. *Now* he had the wild impulse to run: what if there was some blasphemy in the stories? It put him in a cold sweat to think how casually he published new twists on traditional themes, or allowed small inconsistencies into story cycles. And just few days ago, he'd looked forward to testing the Hrala skit with these people!

The tall priest's tone remained friendly: "You have come at an appropriate moment, Master Guille. We have confronted blasphemers—who may be harbingers of the Final Battle. Now is a time when we must consult all sources of Truth." Another priest, an older fellow with a limp, interrupted with something abrupt. The tall guy paused, and looked faintly embarrassed; suddenly Guille knew that he was more than an interpreter, but not one of the high priests. "It will be necessary to inspect both your boat and your persons. More blasphemers may come in fair forms. . . . Don't be angered; it is but a formality. I, we recognize you from before. And if the writings you bring speak to our questions, you can expect payment even more generous than usual."

Away from the pier, the smell of burned petroleum products faded, replaced by a barnyard smell and the acrid stench of the tiny insects that built the mounds. Up close, the tower walls were not smooth sweeps. Glabrous patches were surrounded by warty growths. The "windows" were holes hacked in the irregular surface. Even Seraph's blue light could not make such things beautiful. Behind the front tier of mounds, stone corrals held a few dozen skoats —the source of the farm smell. The place really was a village, similar to backward villages the world over. Without modern science, they had no way of making strong or hard materials. Their spearheads were fire-hardened wood and obsidian. Where the termites did not build for them, their structures were simple piles of stone. . . . It was no wonder travelers had seen no danger from these people; a squad of crossbow armed troops could take them over. No one guessed they had access to petroleum or the knowledge to produce flammables.

They walked some distance through the shadows between the towers. The Great Hall was cut into the side of one of the largest mounds. The resulting talus was formed into steps as broad as those in front of any government building in Crownesse. At the top of the steps, carved barricades blocked the entrance. Rey's guide called something Hurdic and ceremonial-sounding. Spear-toting priests slid the barricades aside.

Their porters carried the crate of *Fantasies* toward the altar at the back of the Hall. The place was exactly as Rey remembered it: at least one hundred feet from entrance to altar, but with a ceiling that was nowhere more than seven feet high. It seemed more like a mine than a building. Twelve-foot-wide pillars stood in a rectangular grid across the floor. The pillars were native mound-stuff painted white. The only light came from ranks of candles that circled each of them. As the Tarulle people walked toward the altar, they saw hundreds of

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Termite Folk standing quietly between the farther pillars. The room couldn't be more than one hundred feet across, but the pillars seemed to go on forever. On his last visit, Rey had walked to the side of the Hall (an act of unknowing bravado, he realized now), and discovered that the pillars there were smaller, more closely spaced, and the walls were painted with the image of more pillars stretching off to a faked infinity; cleverly placed flecks of glass simulated hundreds of faraway candles. Like many primitive folk, the Termiters had their own subtleties.

Rey expected the threatened body searches would come next. Instead, the Tarulle people were gestured to sit before the altar. There was a moment of near silence after Guille was asked to open the crate. Now he could hear a faint buzzing that came from all around, the sound of the real termites. They were, after all, inside an enormous hive. He pulled up the lid of the crate, and the insect sound was lost behind the Villagers' soft chanting.

The high priests lifted the top sheets from the crate. These were color illustrations that would be inside/outside covers on normally bound editions. The color didn't show well in the candlelight, but the Termiters didn't seem to mind; the best pictures from previous issues were mounted in the walls behind the altar. The priests pored over the illos, just like ordinary fans thrilled with the latest issue of their favorite magazine. Before, Rey would have smiled at their enthusiasm. Now he held his breath. At least one of those pictures showed Hrala carrying a spring-gun; could that be blasphemy?

Then the tall priest looked up, and Rey saw that he was smiling. "Wonderful, friend Guille. There is new Insight here. We will pay double." The others were lifting manuscript galleys out of the crate and solemnly laying them on velvet reading stands. There couldn't be more than a handful of locals who knew Spräk; did they *preach* from the stories? Rey let out a carefully controlled breath. It didn't matter now. The Tarulle people had passed the test and—

—outside the Hall, someone was shouting. The words were indistinct, but Hurdic. The priests straightened, listening. The shouts came louder; people were rushing up the steps to the Hall's entrance. The barricades slid aside and Seraph's light shone on the arrivals: they were spear carriers from the pier. They rushed down the aisle, still shouting. Their leader was waving something over his head. Everyone was shouting now. Rey saw that Brailly's men had slipped into a circle formation. Some of them were reaching into their jackets.

Then the newcomer reached the altar, and one of the priests—the old one with the gimp leg—gave an incredible warbling scream. In an instant, all other cries ceased. He took two objects from the guard and held them close to the candles. Strange reflections shifted across his face and the ceiling. . . . He was holding the main mirror and the diagonal bracket from Rey's telescope.

How can he know what these are, much less think them blasphemous? The thought hung for an instant in Rey's mind, and then everything went crazy. The old man threw the mirror to the floor, then turned on the Tarulle visitors

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and shouted in Hurdic. No translation was needed; his face was contorted with hatred. Spearmen ran forward, weapons leveled. Brailly tossed something onto the altar; there was an explosion and swirling gouts of chokesmoke. Rey dived to the floor, tried to belly crawl out from under the choke. He heard Brailly's men fighting their way toward the entrance. By the sound of it, they had some sort of weapons—strip knives probably. There were screams and ugly ripping sounds, all against a background of coughing and nausea. It sounded like all the Villagers had thrown themselves into the fight. They could never get past such a mob!

He had underestimated the Printmaster. From out of the smoke and shouting came Brailly's voice. "Down! We're gonna blast!" Rey tucked his head in his arms. A second later there was a flash of light and invisible hands crashed upon both sides of his head. He looked up. There was blue light ahead! Tounse had knocked the barricade over.

Rey came to his knees. If he could move while the locals lay stunned. . . .

His poor ears couldn't hear the rumbling; it came through his knees and palms. All around them, the hive was shaking. He saw now that the pillars near the entrance had been smashed. Avalanches of moundstuff—first small, then engulfing, spilled down from above.

With that, the tower collapsed on the Great Hall, and Rey saw no more.

Consciousness returned in patches. There were unpleasant dreams. Something was banging his head; it wasn't the knock of his alarm clock. They were dragging him feet first, and his head was bouncing off uneven ground. The dream faded to pleasant grayness, then came back in a new form: he was rolling down a hillside, the rocks cutting into his body.

Rey came to rest in foul-tasting water, and wondered if he would drown before he woke up. Strong hands pulled him from the water. Through the ringing in his ears he heard someone say, "There. A moment of sitting to catch the breath."

He coughed weakly, and looked around. No more dreams: the nightmare was reality. He was sitting by a shallow pond, near the bottom of a pit. The edge of the pit was ten yards above his head, except on one side, where it broke low and gave a view of the harbor. He was not alone. There were dozens of people here—all that remained of the *Science* crew. They clustered around the newly fallen. Looking up at their faces, Rey saw hope in some, fear and despair in others.

"You're looking bad. Can you talk?" It was the woman who had pulled him from the pond. She was in her late fifties, an Osterlai by her accent. Her clothes were neat but stained. There was a matter-of-fact friendliness in her voice. In a moment he would remember who she was.

"Y-yes," he croaked. "What happened?"

The woman gave a short laugh. "You tell us. Five minutes ago it just started raining people. Looks like the Termite Folk have found new blasphemers."

Rey swallowed. "You're right." And it was his fault.

Most of his companions were in worse shape than he. The *Science* prisoners were trying to help, but two of

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the Tarulle people looked freshly dead. Nowhere did he see Brailly Tounse. He glanced at the Osterlai woman and made a wan smile. "We came to rescue you." He gave his captive audience a brief account of the sales landing. "Everything was going fine. I was beginning to think they might listen to us, that we'd at least learn more about your situation. Then they found the mirror from my telescope. How could they know what it was, much less—" He noticed the look on the woman's face.

"And how do you think we got in trouble, my sir? We thought to do some observing from the peaks Inland. We had a twenty inch mirror; the Seraph-seeing should be better here than—" She broke off in surprise. "Why, you're Rey Guille!"

Rey nodded, and she continued, "So I don't have to tell you the details; you've written enough about the idea. . . . I'm Janna Kats, Seraphist at Bergenton; we met once a couple years back." She waved a hand as recognition slowly dawned on Rey. "Anyway. We dragged that mirror ashore, gave the Termiters a look. They thought it was great stuff—till they learned what we wanted to look at." She laughed, but it was not a happy sound. "Lots of religions worship Seraph. You know: home o' the gods and such garbage. Turns out the Termiters think Seraph is something like the gods' bedroom—and mortals mustn't peep!"

So that was how they learned what the parts of a telescope look like. "It still doesn't make sense," Rey said. "In everything else, they seem to be ancestor worshippers; I've sold them dozens of Interior fantasies. How did Seraphidolatry get mixed in?"

The question brought a fit of coughing from the little man sitting beside Kats. "I can answer that." The words were broken by more rasping coughs. The fellow's face seemed shrunken, collapsed; Rey wondered that he could talk at all. "The Termite Folk are intellectual packrats. For three hundred years they've been here, picking up a little of this, a little of that—from whoever was passing through." More coughing. "I should have seen through 'em right off. . . . I've spent my whole life studying coastal barbarians, learning Hurdic. But these folks are so secretive, I didn't understand what was driving them . . . till it was too late." A smile twisted his thin face. "I could get a nice research paper out of what we've learned here. Too bad we gotta die first."

Rey Guille had years of experience finding loopholes in impossible situations—on paper. "Maybe we don't have to die. I never thought the Termiters were killers. If their religion is such a hodgepodge, they can't take the taboos too seriously. You've been here for several days. Maybe they just want a graceful way out." It really made sense. Then he remembered Brailly's bomb, and continued more quietly, "If there's anything they'd kill for, I think it would be what my people did to the Village Hall."

"You don't understand, fellow," a third *Science* person spoke, a sharp edge in his voice. "Knocking over a termite mound is a pecadillo in their eyes —compared to invading the gods' privacy. They've kept us alive this long

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because they're having trouble devising a torture-death appropriate to our crime!"

"How can you know that for sure—"

"We know, Master Guille." Janna Kats's tough exterior broke for an instant, and she looked just as frightened as the others. "In the last two days they've taken three of us from the pit. W-we could hear the screams; one we could see. Each took longer to die than the last."

There was a moment of silence, and then the cougher said, "I think the Termiters are scared, too—of their Seraph gods. If they can't come up with the proper death for us, they think the gods will apply that death to *them*. The three they killed were . . . little experiments."

"But there will be no more." The toughness was back in Janna's voice. "The next time they come, one big surprise we'll show them. We won't be skoats waiting for the slaughter."

Rey looked up, at the rim of the pit. There were Termite Folk all around. Most carried spears, but that wasn't the most deadly thing; spears kill one a time, make a slow thing of a massacre. Much more ominous were the priests carrying torches. They stood near the three petroleum vats Brailly had spotted earlier. Each tank was mounted on a crude swivel. Should they choose, the torch bearers could drown their prisoners in flame. A few hours before, that prospect had filled him with sympathetic dread. For Janna and the others, it had come to be the only imaginable out.

The hours passed. At the top of the sky, Seraph widened toward full, its western ocean turning dark and reddish with the start of the mid-night eclipse. The Villagers marched steady patrols around the edge of the pit. Mostly they were silent. The *Science*'s anthropologist said they had long ago stopped responding to his shouted questions.

There were no more "experiments," but Rey gradually realized the pit was in itself a killing place. The only water was in the shallow pool at the bottom of the pit—and that became steadily more foul. The only food was what the Villagers threw into the pit—slabs of skoat cheese and balls of what turned out to be pressed termite larva. Rey had eaten some exotic things in his years with Tarulle, but the larva patties were half rotted. Hungry as they were, only a few of the prisoners could keep them down. Three of the Tarulle prisoners were dead, their bodies broken by the explosion. Two of the survivors had compound fractures; their moans came less frequently with each passing hour.

The prisoners were not alone in the pit. The true builders of the Village were here, too. In the silence that dragged between conversations and occasional moaning, Rey heard a *scritching* sound coming from all directions. At the corner of his vision, a pebble would move, something would scuttle from one hole to another. The termites were no bigger than a man's thumb, but there must be millions of them in the sides of the pit. They avoided the humans, but their activity was ceaseless. The sides of the pit were not ordinary earth. All the way down to the pool, this was moundstuff. It must be old, the detritus of thousands of years of towers, but it was still used by the tiny creatures. The stones in this

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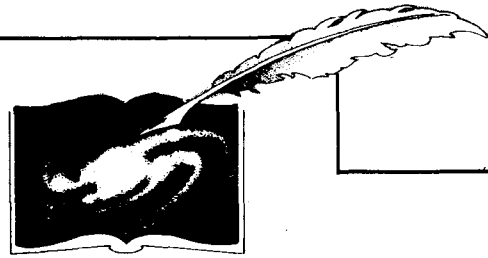

About L. RON HUBBARD's

Writers of the Future Contest

by Algis Budrys

The Writers of the Future contest substantially rewards at least twelve talented new speculative fiction writers each year. With no strings, every three months it confers prizes of $500, $750 and $1,000 for short stories or novelettes. In addition, there's an annual Master Prize of $4,000. All awards are symbolized by trophies or framed certificates, so there's something for the mantelpiece too.

There's also a Writers of the Future anthology, which I edit. (There was one last year, and there's another one just out as you read this.) It offers top rates for limited rights in the stories. These payments are in addition to any contest winnings. The anthology is distributed through top paperback book retailers everywhere, and is kept in print and on sale continually. All that's required to win or to be a finalist is a good new story, any kind of fantasy or science fiction, no more than 17,000 words long, by writers whose published fiction has been no more than three short stories or one novelette. Entry is free.

The contest deadlines in 1986 are March 31, June 30, and September 30, and there are First, Second and Third prizes for each three-month quarter. At the end of our year, a separate panel of judges awards a Master Prize to the best of the four quarterly winners. So one person will win a total of $5,000. Judging panels include or have included Gregory Benford, Stephen Goldin, Frank Herbert, Anne McCaffrey, C.L. Moore, Larry Niven, Frederik Pohl, Robert Silverberg, Theodore Sturgeon, Jack Williamson, Gene Wolfe and Roger Zelazny, as well as me. Matters are administered so that the judges are totally independent and have the final say.

It seems hardly necessary to embellish the above facts with any enthusiastic adjectives. This contest was created and sponsored by L. Ron Hubbard and the project will continue in 1986 and try to do some realistic good for people whose talent earns them this consideration. For complete entry rules, and answers to any questions you might have, write to the address given below:

Don't Delay! Send Your Entry To:

Writers of the Future Contest
2210 Wilshire Blvd., Suite 343
Santa Monica, CA 90403

Or, you can find the rules—and examples of winning stories, plus informative essays by some of the judges—in either of the Writers of the Future anthologies. They're original paperbacks and cost $3.95 each.

Good luck.

—Algis Budrys

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"soil" must have washed down from the hills to the north. The coming of humans was a recent event in the hives' history.

The towers of the Village crowded around three sides of the pit, but beyond the broken southern lip, they could see the harbor. The Tarulle Barge was less than a quarter mile out. Deck piled on deck, loading cranes sticking out in all directions, masts rising slim into the reddish blue sky—the Barge had never seemed so beautiful to Rey as now. Safety was just twelve hundred feet away; it might as well be the other side of Seraph. An hour earlier, a hydrofoil had arrived from the ocean and docked in a starboard slip. There was no other boat activity, though Rey fancied he saw motion on the bridge: another meeting? And this time, a final decision to leave?

Most of the prisoners huddled on the north slope of the depression; the corpses were carried to the other side of the pit. The prisoners were bright people. They'd had plenty of time to try to figure a way out, and no success in doing so. The arrival of Rey's group brought new hope, even though the rescue had been a failure. For an hour or two, there was renewed scheming. When it became clear that nothing had really changed, the talk gradually petered out. Many of the prisoners drifted back to inward-looking silence.

There were exceptions. One thing Rey loved about scientists was *their* love for speculation. Take Tredi Bekjer, the little guy who spent the hours coughing his lungs out. Tredi was a sickly fellow who should never have been on the *Science* expedition in the first place. He was an anthropologist, and the only captive who spoke fluent Hurdic. He might be dying, but between spasms of coughing he argued about the origin and future of their captors. He predicted that—no matter what the prisoners' fate—the ambush had doomed the Termiter culture. Now, outsiders knew there was petroleum nearby. When that news got to the archipelagates, the Termiter Folk would have lots of visitors. Even if the locals were not booted off their land, they would be forced to make big changes. In thirty years, there would be a *real* city here.

There were others like Tredi, folks who could walk through the gates of death, still arguing about ideas. When the planning and the scheming was done, these few still had something to talk about. Rey found himself drawn in.

Janna Kats was the most interesting. Before specializing in Seraphy, she'd had lots of experience with other branches of astronomy. She was just the sort of person he'd been hoping to talk to—back when he thought they'd find the *Science* in one piece. For minutes at a time Rey could forget where he was, and what his fate must be. Kats had had great plans for the Seraph observatory. There should be good seeing from the mountains behind the harbor. Ground resolutions better than one hundred yards would have been possible with the twenty-inch mirror. The issue of intelligent life on Seraph might finally be resolved. . . . Instead, the project had brought them all to this pit.

Rey grunted. "Other things are happening in astronomy. Things that aren't so dangerous. There have been some fantastic discoveries at Krirsarque." He described "Pride of Iron" and the spec-

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troscopic observations it was based on. "Can you imagine! With spectroscopy, we can know what things are like on planets around other stars." He sat back, waiting for Janna's reaction to this news. It was one of the occasional pleasures of his job, to be the first person in an entire archipelagate to report a breakthrough.

Janna grinned back at him, but there was no surprise in her expression. "Ha! That's one of the results the U. Tsanart people sent west with *Science*. During the last year, they've got good spectra on twenty stars in our sun's class. Every damn one of 'em is metal rich. And we have other results, too. We can measure radial motions with this spectro stuff—" She laughed at the expression on his face. "You've written a lot of high-flown editorials about 'Spectroscopy, Key to the Universe.' Well, you may have understated the case. Combine the spectral shift data with proper motion studies, and it's obvious our solar system is an interloper, just passing through the local star stream."

Outcast Star. The title flashed through Rey's mind. There were writers who could run away with that idea—and surely would, if he got out of this alive. "You know, it's almost as if someone were picking on the human race," he mused. "Out of all the solar systems, that we should be the low metal one, the outsider." He didn't like the idea. It smacked of the theistic fantasy Cor Ascuasenya so loved: humanity as doormat to the gods.

"You've got it backward, my sir. Ever hear of the anthropic principle? Most likely, intelligent life exists on Tu *exactly because* we are different from the others. Think what an abundance of metals would mean. It's not just a matter of wealth, millions of ounces of iron available for large scale construction. My guess is such concentrations of metals would change the surface chemistry so much that life would never develop."

Janna's middle-aged features were filled with a happy smugness, but Rey did not feel put down. He was imagining deadly, treasure-house worlds. "Or life might develop, but different than here. Why, there might be—"

Janna abruptly grabbed his arm. She was looking past him, her expression intent; his speculations were suddenly of zero interest. There were scattered gasps from the prisoners. He turned and looked into the harbor. The Barge had lowered a boat to the water. It glowed with white light, a jewel in the reddening dimness. Then he realized that Tarulle had lit a flare at the focus of the bridge's signal mirror. Its light fell dazzling on the boat—which was nothing more than a freight lander painted silver and white. Before the flare guttered out, two more were lit at other mirrors. They tracked the boat as it started toward shore.

The Termiter priests were suddenly shouting. One group of spear carriers ran to the south side of the pit, while others moved to the pet' vats and slid the covers aside. Priests dipped their torches into the vats—and the night exploded. The thunder went on and on, drowning the shouts of prisoners and Villagers alike. Flame and smoke rose from the petroleum, swirls of red and black across the mid-night eclipse. Hundreds of bats swarmed drunkenly in the superheated air, burning, falling.

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The stench of pet' was everywhere. The Termiters cowered back from the pyres they had created, but Rey saw a few priests near each, setting long poles against the sides of the vats. A few good pushes, and the prison pit would be wall-to-wall fire.

Some of the prisoners collapsed, their mouths open, eyes wide. They must be screaming. Beside him, Janna Kats had caught his arm in both her hands. Her eyes were clenched shut, her face averted from the fires. Something in Rey's mind retreated and suddenly he wasn't frightened. He wasn't brave; he simply couldn't grasp the reality of his imminent torch-hood. He looked back to the harbor. The firing of the vats hadn't stopped the boat. It floated serenely toward them, still lit by the Barge's flares. He strained to see what it was carrying. The oarsmen wore black robes, their faces hidden within deep cowls. Those weren't Tarulle uniforms, yet they were somehow familiar. There was only one other person on the boat. She stood at the bow, scorning all support. Her clothes were white and silver, gleaming in the faraway spotlights. Black hair cascaded around her face and shoulders.

Now Rey understood this latest rescue attempt. He damned and thanked Cor all at once for trying.

Tarulle doused the flares the instant the lighter touched shore. In the roaring red dimness, the figure on the boat was a vague thing. She did something to her robes and suddenly was near naked, and incredibly female. When she swung over the railing, red-silver glinted from her breasts and thighs. The oarsmen followed, clumsy black beetles by comparison. They started up the hillside, and were lost to Rey's view beyond the south side of the pit . . .

. . . but not lost to the Termiters'. The spear carriers hadn't moved, but every face was turned toward the approaching party. The priests by the fire vats had dropped their poles, and stared in shock. Janna's grip loosened. She tried to ask him something, but even shouting mouth to ear, she couldn't talk over the flame-roar. Rey could only point to the rim of the pit.

A minute passed. Villagers at the southeast corner of the pit backed away . . . and the newcomers appeared. *By the Light,* what a job Cor had done! It was strange to see—in the middle of terrible, deadly reality—the incarnation of a hundred fantasies. This *was* Hrala, complete with a contingent of the Sibhood Sinistre. The Sibhood followed Hrala through most of the stories. Their motives were beyond knowing, but seemed more evil than not. Sometimes they were Hrala's deadliest enemies, sometimes her allies. When they were her allies, the rest of the world better watch out. The black-cowled figures hung silently behind her, looking a dozen times more deadly than any Termiter priests.

The fraud would have been nothing without its central character. Tatja Grimm had come to Tarulle an outsized waif. The makeup people had transformed her. Black hair lapped smooth down to her waist, a perfect copy of all the illustrations. Her body was evenly tanned, though all she wore was ribbon armor, and that only around her hips and breasts. If he hadn't seen the girl before, Rey never would have guessed that bosom was faked. She carried the blade

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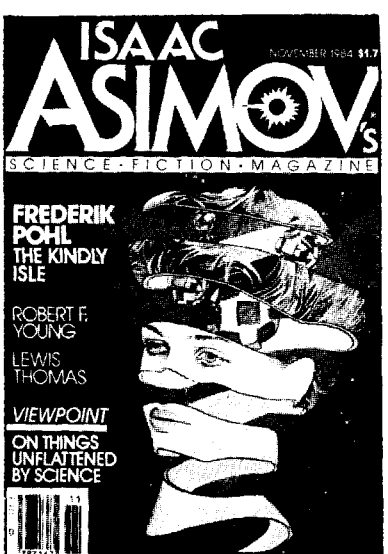

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named *Death*. Crafted of "magic metal," edged with diamonds, it was a living creature and one of Hrala's earliest conquests. Without her control, it would take up its original mission—to corrupt the powerful and scourge The Continent. In fact, the prop was carved from puffwood painted silver and edged with quartz. Any sharp blow would shatter it.

Tatja Grimm walked forward, *Death*'s flat resting on her shoulder as though it weighed pounds and not ounces. Cor had coached her well. Every motion was fluid, arrogant. She walked straight to a high point on the pit's rim. For a long moment, she surveyed the priests and the flaming vats. Not once did she look at the spear carriers. The Villagers stared back, eyes wide. Rey could see the fear mounting in them.

Abruptly, Hrala's hand flashed out. She pointed at the vats and clenched her fist. The Barbarian Princess wanted those fires *out*. The Termiter priests scrambled to push the lids back onto the vats. Flames burst sideways, searing the priests, but one by one the lids were forced into place. There were scattered explosions; one of the vats trembled in its cradle. Then a great silence replaced the roar. For a long moment, everyone listened to the ringing in their ears.

Rey couldn't believe his eyes or ears. Did the Termiter priests actually believe the stories? Of course, the instant the girl opened her mouth the illusion would be broken—

The Grimm girl turned, gestured the chief Sib to stand close behind her. The cowled figure slid forward, servile and sneaky at the same time. That must be Coronadas Ascuasenya; she might just be close enough to prompt the girl. There was a hissing conversation between the two, broken off by an imperious gesture from the Princess. She looked back at the Termiters and finally spoke. The words rattled fast, diamond hard. They were not Spräk.

Tredi Bekjer gasped. He crawled the few feet that separated him from Rey. "That's Hurdic!"

Janna and Rey dropped to their knees beside him. "What's she saying?"

Bekjer listened a moment more. "Hard to follow. She's speaks a deep Interior dialect. . . . I've only heard it a couple times." He choked back a coughing spasm. "Says she's angry as . . . the hot pits of the earth. Termiters have no business holding her . . . property? prey? She means us, in any case. She demands reparations, replacements for the dead, and—" Tredi laughed and coughed at the same time "—and the return of the survivors."

The sharp-voiced speech ended. The Barbarian Princess stood waiting a reply. *Death* twitched in her hand, impatient to forego these diplomatic niceties.

A voice came from the priests. After a second, Rey recognized it as belonging to the tall Termiter. The words were tentative and quavery, totally lacking the menace Tatja/Hrala put into hers. Tredi continued his translation: "Local guy is explaining our blasphemy. Case you can't tell, he's practically wetting his pants. . . . If he doesn't punish us, the High Gods will torture-kill his people. And now Hrala is threatening to skewer his guts if he doesn't let us go. He's caught between two dooms."

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Hrala had a reply. She swung *Death* from her shoulder and thrust it skyward. The fake metal gleamed red-silver, "diamonds" glittering. Her speech was as angry and decisive as before. Tredi's translation consisted of a single, soft-spoken, "*Wow.*" Janna punched his shoulder, and the little anthropologist remembered his listeners. "Whoever she is, she's wonderful. . . . She told the Termiter to remember his place, that he's too *low* in the scheme of things to *presume* upon the High Gods' vengeance. . . . I can't translate it any better; she packed a freight-load of hauteur into a couple sentences. She's telling him, if her property is offensive, then that's something between Hrala and the Gods."

Rey Guille looked from Tatja Grimm to the clustered priests. Hope was a sudden, wonderful thing. Every state religion he'd ever seen had a core of hypocrisy. That was why he'd been against bringing "Hrala" ashore—he knew the priests would never accept their theology suddenly incarnate. But Cor and the Grimm girl had taken the risk, and now, incredibly, the plan was working.

For several minutes the priests had no reply. They stood in a tight group, speaking in low voices. Around them, the spear carriers held their weapons loosely, their eyes never leaving Tatja Grimm. From beyond the rim, an anonymous voice called, "Hrala." After a moment, one of the spear carriers repeated: "Hra-la." The word was passed back and forth among the low-ranking Termiters. They pronounced the guttural "H" with a force and precision that made Rey wince. "Hra-la. Hra-la. Hra La. Hra La . . . The chant spread around the pit, a soft drumbeat.

One of the priests shouted; the chant stumbled, guttered out. After a moment, the priest continued. His voice was placating, but without the quavering fear of before. "New guy," said Tredi. "He's talking humble, sweet as sugar. Says that for sure Hrala's claim takes precedence over theirs, but—" Tredi sucked in a breath. "*Bastard!* He says, in dealing with beings so deadly as the High Gods, his people need at least to go through the motions . . . of verifying Hrala's identity."

Another priest spoke up, his voice high-pitched and not nearly as confident as the first. " 'A mere formality,' the second jerk says."

"S-so what's the *formality,* Tredi!" Janna all but shook the little man.

Bekjer listened a second longer, then caught back a sob. "Nothing much. A little trial by combat."

Rey's eyes stayed on Tatja Grimm all through this speech. She didn't flinch. If anything she stood taller now, her chin raised at the impudence of the "request." No amount of coaching could have taught her to do that: the girl was as gutsy as anyone he'd ever known. When the priest finished, her reply was immediate, a sharp three syllables filled with anger and arrogance.

" 'Certainly,' she says," Bekjer translated unnecessarily.

And Rey's hope fled as quickly as it had come. The girl looked down at *Death*, and for an instant he saw the gawky youngster who had come aboard Tarulle just a few days before. She wasn't afraid, just uncertain, feeling her way in a strange situation. The puff-wood sword was a magnificent bluff,

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but they were beyond bluffs now. It couldn't cut butter, and it would shatter at the first blow.

The girl gestured imperiously at the chief Sib, the one who must be Coronadas Ascuasenya. The Sib slid forward, and spoke hissingly into Hrala's ear. The rescue party was about out of options. No doubt they were heavily armed. If they acted quickly, while the tattered bluff had some credibility, they could probably fight their way back to the landing boat—and at least save themselves.

Hrala listened to the Sib for a moment, then interrupted. The two were arguing! It was consistent with all the stories, but why now? Cor's hissing broke into full voice for an instant, and suddenly he realized this was no sham. Hrala shook her head abruptly, and handed her sword to the Sib. Cor sank beneath the pretended weight of *Death*. She didn't have much choice now. She slunk back to the other Sibs, her fear obvious but suddenly in character: She held *Death* in her hands. As a Sib Sinistre, she could not be perverted by it (the Sibhood was already pretty perverse), but possessing *Death* and being possessed by it were very close things. It was a theme Rey had insinuated into the series himself.

Hrala turned back to the Termiter Priests. She was smiling, and the anger was gone from her words; mocking arrogance remained.

"Says she's happy to fight, but it's no . . . fun . . . wasting *Death* on such easy prey as the Termiters. She'll fight with whatever weapons her opponent chooses."

That almost started the chant again. The priests shouted it down, and after a moment one of them carried a sword-club toward Hrala/Tatja. This fellow was no fighter, just an errand boy. He laid the club on the ground ten feet from the girl, then scuttled back to safety. Hrala let him depart, then stepped from the high ground to inspect the weapon.

"If she's from deep Inland, she's never seen a sword-club," said Tredi. "Spears and pikes are all the Inlanders have. Even on the coast, it's a ceremonial weapon."

This one was clearly for special occasions; the wood was polished, unmarred. Without metals or composite materials, true swords were impossible. It looked deadly all the same. In overall shape it was something between a club and a pike. Elaborate hooks and blades —of bone or obsidian—were set along its length. There was a spike of glassy blackness at one end, and a hilt at the other. A second grip was set halfway down the pole; perhaps the thing could be used like a quarterstaff.

Hrala/Tatja picked it up, clearly as mystified as Rey. Somehow the puzzlement didn't take her out of character: she smiled her curiosity, seeming to say *how interesting, how clever*. He couldn't tell if she were acting or if this were the same frank wonderment he'd seen in her before. She swung it through a couple of clean arcs, then paused, glanced hesitantly at Cor and the others. Rey understood; this was her last chance to cut and run. Cor started toward her, but the girl turned away and shouted at the priests.

"She says she's ready."

Rey scarcely realized he was holding his breath. The girl *could win*. The

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spear-carriers were already sold on the fraud; none of them could fight effectively. The more cynical priests weren't fooled, but they were exactly the sort that let others do their fighting. Who did that leave? Mental subnormals, too stupid to be afraid?

The crowd of priests parted and someone very broad and heavy started up the incline toward Tatja Grimm. The man's gait was slow, almost shambling. Even from here Rey could see the dullness in his features. *Thank the Light!*

Then he saw the second one.

They were nearly identical—giant, stupid . . . and armed. They carried their sword-clubs before them, both as threat and shield. Each was dressed in heavy leather. It was primitive armor, but at least real; Tatja Grimm was virtually naked, what armor she wore a gaudy fake.

Together, they outweighed her three to one.

The two separated as they approached the girl. They stopped ten feet from her, and for a moment the combatants stared at each other. Rey thought he saw traces of anxiety in the dullards' manner; you'd have to be a vegetable to ignore the mood of the Villagers and the deadly confidence that came from the enemy.

Twenty years of fantasy collided with reality tonight—and for an instant the fantasy seemed the truer vision. The scene would have made a perfect cover painting: Hrala standing straight and fearless before a pair of subhuman attackers, a city of towers spreading on and on behind her. The last blue had disappeared from Seraph's eastern ocean. The disk shaded from brighter reds to darker. The cloud of tarry smoke from the pet' vats still hung in the air, roiling Seraph's continents out of all recognition. Everything—towers, prisoners, priests, fighters—was lit with shifting reds. It was the color of blood, *Hrala's color*, the background color of her most chilling battles.

A priest shouted at the swordsmen, and the moment passed. They came in from opposite sides, their bladed clubs swinging. The girl grabbed her club at the hilt and foregrip and whirled between them. They were slow, and Tatja Grimm was terribly quick. That could only save her from quick death: She danced backwards, up the rise. She used the club like a staff, blocking. Blade fragments flew from every blow.

She bounded three great steps back, and moved both hands to the hilt of the club. She swung it in a quick sweep, her greater reach keeping the two back—till they separated again and came at her from the sides. Even so, she wasn't retreating now.

"She learns very fast," Tredi said to no one in particular.

But some lessons are learned the hard way. The bladed hooks were good for more than terror and disemboweling. One of her parries brought a crashing halt; her club had locked with the attacker's. The swordsman raised his club, swinging her slender body against him. Tatja kicked and kneed him. Even in his armor, the fellow staggered beneath the blows. The second attacker ran forward, rammed the point of his club squarely at the girl's torso. Somehow she sensed the attack, and threw herself backwards. The impaling thrust was turned into a deep slash across her chest.

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She hit the ground and bounced instantly to her feet. For a moment the action stopped and the antagonists stared at each other, shocked. In the smoky dimness, details were vague . . . yet the fake bosom still seemed to be in place. Everyone could see that the armor around her chest had been slashed open. Everyone could see the ripping wound across her breasts. Everyone could see that Hrala *did not bleed*.

The second swordsman stepped backwards and whimpered. His tiny brain finally realized that he should be terrified. He dropped his club and ran from both priests and Hrala.

The first fellow didn't seem to notice. He flipped Hrala's club over his head and advanced on her. She didn't retreat, didn't try to rush around him to the discarded clubs; she stood with knees slightly bent, hands held open. Only when the bladed club swung toward her middle did she move—and then it was too fast for Rey to follow. Somehow she caught the foregrip of the club, used it as a brace to swing her body up and ram her foot into the other's throat. The blow jarred the club loose, and the two fell in an apparently random tangle. But only one combatant rose from that fall. The other lay twitching, the point of a sword-club struck through his skull.

The girl stared at the dying man. A look that might have been horror passed across her face; her arms and shoulders were shaking. Suddenly she straightened and stepped back. When she looked at the priests, haughty pride was back in her features.

"Hrala. Hra-la. Hra La. *Hra La* . . ." The chant began again. This time, no priest dared shout it down.

* * *

Coronadas Ascuasenya had plenty of contact with the rescued during the next few days. Some recovered from the horror better than others. Janna Kats could laugh with good humor within ten hours of the rescue. The little anthropologist, Tredi Bekjer, was almost as cool, though it would be some time before his body recovered.

But four days out from the Village, some of the *Science* people were still starting at shadows, crying without provocation. And for every survivor, there would always be nightmares.

Cor had never considered herself especially brave, but she hadn't been trapped in that pit; she hadn't seen friends torture-murdered. Once they returned to the Barge, and the Village was irrevocably behind them, it was easy to put the terror from her mind. She could enjoy the Welcoming Back, the honor given her and Rey Guille and Brailly Tounse, the greater honor given Tatja Grimm.

It was as close to a storybook ending as could be imagined. Thirty-six from the *Science* had died, but nearly one hundred had survived the adventure and would return with the Barge (much to the surprise of their sponsoring universities, who hadn't expected to see them for two years). When Tarulle sailed into the Osterlais—and later the Tsanarts—everyone would be instant celebrities. It would be the story of the decade, and an immensely profitable affair for the Tarulle Publishing Company. Whatever their normal job slot, every literate participant in the rescue had been ordered to write an account of the operation. There was talk of starting

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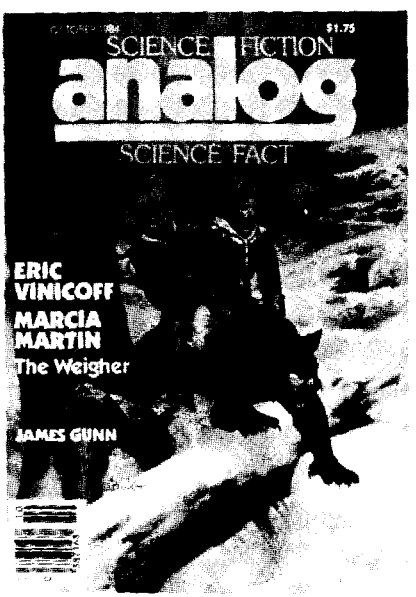

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a whole new magazine to report such true adventures.

And management seemed to think that Cor and Rey had masterminded this publishing coup. After all, he had suggested the landing; she had produced Tatja/Hrala. Cor knew how much this bothered Rey. He had tried to convince Svektr Ramsey that he had fallen into things without the least commercial savvy. Of course, Ramsey knew that, but he wasn't about to let Rey wriggle free. So Guille was stuck with producing the centerpiece account of the rescue.

"Don't worry about it, Boss. They don't want the truth." She and the *Fantasie* editor were standing at the railing of the top editorial deck. Except for the masts and Jespen Tarulle's penthouse, this was as high as you could get on the Barge. It was one of Cor's favorite places: a third of the Barge's decks were visible from here, and the view of the horizon was not blocked by rigging and sails. It was early and the morning bustle had not begun. A cold salt wind came steadily across the deck. That air was so clean—not a trace of tarry smoke. White tops showed across miles of ocean. Nowhere was there sign of land. It was hard to imagine any place farther from the Village of the Towers.

Rey didn't answer immediately. He was watching something on the print deck. He drew his jacket close, and looked at her. "It doesn't matter. We can write the truth. They won't understand. Anyone who wasn't there, won't understand." Cor had been there. She *did* understand . . . but wished she didn't.

Rey turned back to watch the print deck, and Cor saw the object of his interest: The man wore ordinary crew fatigues. He wandered slowly along the outer balcony of the deck. He was either lonely, or bored—or fascinated by every detail of the railing and deck. Cor suspected the fellow wasn't bored: Part of the Hrala fraud had been the demand that the Termiters replace her damaged "property" (the dead from Brailly's party and the *Science*). It seemed unwise to retract the demand completely, so five unfortunate Villagers were taken aboard.

This was one of them; he had been a Termiter priest—their spokesman/interpreter. Cor had talked to him several times since the rescue; he made very good copy. He turned out to be a real innocent, not one of the maniacs or hard core cynics. In fact, he had fallen from favor when the cynics pushed for trial by combat. He had never left the Village before; all his Spräk came from reading magazines and talking to travelers. What had first seemed a terrible punishment was now turning out to be the experience of his lifetime. "The guy's a natural scholar, Boss. We drop the others off at the first hospitable landing, but I hope he wants to stay. If he could learn about civilization, return home in a year or so . . . He could do his people a lot of good. They'll need to understand the outside world when the petroleum hunters come "

Rey wasn't paying attention. He pointed farther down the deck.

It was Tatja Grimm. She was looking across the sea, her tall form slumped so her elbows rested on the railing and her hands cupped her chin. The ex-priest

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must have seen her at that instant. He came to an abrupt halt, and his whole body seemed to shiver.

"Does he *know?*"

Rey shook his head. "I think he does now."

In many ways the girl was different from that night at the Village. Her hair was short and red. Without the fake bust, she was a skinny preteener—and by her bearing, a discouraged one. But she was nearly six feet tall, and her face was something you would never forget after that night. The priest walked slowly toward her, every step a struggle. His hands grasped the railing like a lifeline.

Then the girl glanced at him, and for an instant it seemed the Termiter would run off. Instead, he bowed . . . and they talked. From up on the editorial deck, Cor couldn't hear a word. Besides, they were probably speaking Hurdic. It didn't matter. She could imagine the conversation.

They were an odd combination: The priest sometimes shaking, sometimes bowing, his life's beliefs being shot from under him; the girl, still slouched against the railing, paying more attention to the sea than to the conversation. Even during the Welcoming Back she had been like this. The praise had left her untouched; her listless replies had come from far away, punctuated by an occasional calculating look that Cor found more unsettling than the apathy.

After several minutes, the priest gave a final bow, and walked away. Only now, he didn't need the railing. Cor wondered what it must be like to suddenly learn that supernatural fears were unnecessary. For herself, the turn of belief was in the opposite direction.

Rey said, "There's a rational explanation for Tatja Grimm. For years we've been buying Contrivance Fiction about alien invaders. We were just too blind to see that it's finally happened."

"A visitor from the stars, eh?" Cor smiled weakly.

"Well, do you have a better explanation?"

". . . No." But Cor knew Tatja well enough to believe her story. She really was from the Interior. Her tribe's only weapons were spears and hand axes. Their greatest "technical" skill was sniffing out seasonal springs. She'd run away when she was eight. She moved from tribe to tribe—always toward the more advanced ones. She never found what she was looking for. ". . . She's a very quick learner."

"Yeah. A quick learner. Tredi Bekjer said that, too. It's the key to everything. I should have caught on the minute I heard how Jimi found her 'praying' to the noontime shadow of her quarterstaff. There she had reproduced one of the great experiments of all time—and I put it down to religion! You're right; there's no way she could be from an advanced civilization. She didn't recognize my telescope. The whole idea of magnification was novel to her. . . . Yet she understood the principle as soon as she saw the mirror."

Cor looked down at the print deck, at the girl who seemed so sad and ordinary. There had been a time when Cor felt the start of friendship with the girl. It could never be. Tatja Grimm was like a hydrofoil first seen far astern. For a while she had been insignificant, strug-

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gling past obstacles Cor scarcely remembered. Then she pulled even. Cor remembered the last day of rehearsals; sympathy had chilled and turned to awe—as Cor realized just how *fast* Tatja was moving. In the future, she would sweep into a faraway Coronadas Ascuasenya could never imagine. "And now she understands us, and knows we are just as dumb as all the others."

Rey nodded uncertainly. "I think so. At first she was triumphant; our toys are so much nicer than any tribe's. Then she realized they were the product of centuries of slow invention. She can search the whole world now, but she won't find anything better."

So here she must make the best of things. "I-I really do have a theory, Boss. Those old stories of fate and gods, the ones you're so down on? If they were true, she would fit right in, a god who is just awakened. When she understands this, and sees her place in the world. . . . She talked to me after the Welcoming Back. Her Språk is good now; there was no mistaking her meaning. She thanked me for the Hrala-coaching. She thanked me for showing her the power of fraud, for showing her that people can be used as easy as any other tool."

For a long while, Rey had no response. ■

IN TIMES TO COME

● Science fiction (and real-life technologists) have considered a wide range of places where human beings might build new settlements: under the oceans, in various types of Earth orbits, on the Moon or other planets. . . . There's at least one possibility that hasn't got so much attention so far, despite being quite close to home—perhaps because it might take pretty special circumstances to make it seem preferable to all those other options. But those circumstances are far from unimaginable, and therein lies the basis of our October cover story, Eric Vinicoff's "Windrider." What do you do if the Earth's surface is largely uninhabitable, you don't have the wherewithal to go very far from it, and you're not willing to die?

George W. Harper's fact article may be considered distantly related to Vinicoff's story. It bears the unlikely-sounding title, "A Little More Pollution, Please!" which sounds absurd—but have you really thought about exactly what you *mean* by "pollution"?

We'll also have assorted fiction by such writers as P. M. Fergusson, Colin Kapp, and Joseph H. Delaney.

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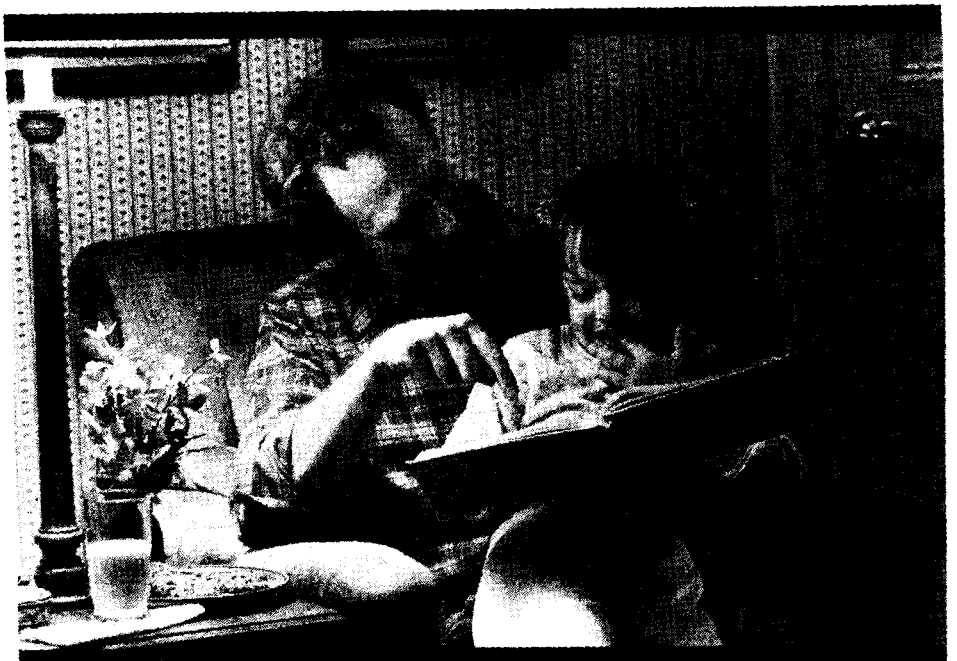

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Charles R. Pellegrino
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MAKING STAR TREK REAL

Who Goes There, and Why Should We?

In 1980, as *Voyagers 1* and *2* hurtled toward Saturn, as *Salyut 6* orbited the Earth and the space shuttle *Columbia* was being readied for its maiden voyage, hints that a long-suspected, long-hoped-for class of objects really existed began to surface. Combining measurements of the minute wobbling motions of nearby stars with very precise infrared observations, D.W. McArthy and his associates at the University of Arizona started unveiling faint companions near other stars. The companions' masses ranged down to and below 85 Jupiters—which is close to minimum mass predicted for the ignition of the fusion reactions that would turn them into full-fledged stars. Saturn- and Jupiter-like in appearance, they are called brown dwarfs.

The very existence of such small stellar companions implies that still smaller objects remain to be found—objects as small, perhaps, as planets.

A recent sky survey by the U.S.-Dutch-British Infrared Astronomy Satellite (IRAS) has revealed halos of solid, dust-sized particles in orbit around more than 70 nearby stars—including several binary systems. One Sun-like star, Epsilon Eridani (distance = 10.69 light-years, mass = 0.8 relative to the Sun), is surrounded by a ring of debris so dense that bodies as large as asteroids *must* be embedded in it.[1] In this case, the inverse of the brown dwarf argument holds true: the existence of solid particles larger than individual molecules implies that still larger stellar companions remain to be found—objects as

[1] It is worth noting that IRAS also revealed a similar dusty halo in our own solar system, between the orbits of Mars and Jupiter.

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large, perhaps, as planets.

As yet, no signatures of planets have been detected around our second nearest stellar neighbor, Alpha Centauri A. This is primarily because nobody is looking there, and secondarily because Alpha Centauri A is a Southern Hemisphere star, and the latest and most expensive equipment is concentrated with most of the world's land and the people who live on it—in the Northern Hemisphere.

Exobiologists, a handful of scientists with the curious distinction of not yet knowing that their subject matter exists, have traditionally shunned Alpha Centauri A because, like half of the stars in the sky, it is part of a multiple star system. Every new class of astronomy students has been warned that multiple star systems cannot have planets in stable orbits. In order to merit such repetition, one would think that this "fact" was based upon hard computer models and observational evidence.

No. Just another self-perpetuating textbook dogma, not unlike Stephen Jay Gould's "Misnamed, Mistreated, and Misunderstood Irish Elk" (which, he tells us, is neither Irish nor an elk). We might have guessed as much from a quick look at the brown dwarfs that orbit outside the asteroid belt, each of them a star that has failed to accummulate enough mass to burn brightly, each of them a solar system within our solar system.

From computer simulations of the orbits of hypothetical sister stars and their associated planets, Robert and Betty Harrington of the U.S. Naval Observatory in Washington, DC and David Black of NASA's Ames Research Center have concluded that a planet near a star of approximately one solar mass will have a stable orbit as long as a second star with a gravitational pull equivalent to one solar mass never approaches within 3.5 times the planetary orbit's radius.

Alph Centauri A weighs in at 1.1 solar mass. Alpha Centauri B weighs 0.89 solar mass. The two stars are separated by a minimum distance of 11 astronomical units (an astronomical unit is equivalent to 149 million kilometers, the mean distance between the Earth and the Sun). If Alpha Centauri B were to be inserted into our own solar system at the same distance, it would lie between the orbits of Saturn and Uranus. Both planets would be flung immediately out of the solar system. Farther out, at a mean distance of 34.79 astronomical units from the Sun, Neptune, Pluto, and Charon would suffer the same fate. Jupiter and its moons, 5.20 astronomical units from the sun, would orbit like drunkards, but Mars, 1.52 astronomical units away, would have a stable orbit, as would the Earth, Venus, and Mercury.

If, instead of inserting Alpha Centauri B suddenly between the orbits of Saturn and Uranus, we allow ourselves to imagine the star forming *with* our Sun, then the matter that has accreted to form Saturn, Uranus, and their satellites, rather than being cast out of the solar system, forms as planets around the second sun—much as Jupiter, although it resides much closer to the sun than Alpha Centauri A and B are to each other, has nevertheless managed to acquire no fewer than fourteen satellites, each of

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them a world in its own right.

Alpha Centauri A and B are far enough apart from each other that any planets located in their habitable zones will have stable orbits. And that is one of the things that makes the Alpha Centauri system so important: the fact that there are two habitable zones—two places for life to get a start on the surface of an appropriate world. Solar systems like our own can provide only one chance.

Another thing that makes the Alpha Centauri system important is its spectral signature. It is astonishingly similar to our Sun's—even down to the unlikely ratio of one atom of iron to every 31,620 atoms of hydrogen, which suggests that the star was born from the same elemental background as our sun; that is, at almost the same point in the galaxy's history. Unlike most stars in the sky, Centaurus is old enough to have evolved biospheres as complex as the Earth's.

Far from being the last places we should consider as habitats for extraterrestrial life, we see in the suns of Centaurus the ultimate fantasy: The possibility of two life-bearing, Earth-like worlds in the same solar system.

But it is not enough to speculate about what worlds might be out there, and who might be on them.

We want to know.

A new generation of infrared astronomy satellites, now being designed by NASA, should be able to tell us if planets with just the right amount of mass to support just the right kind of atmosphere are orbiting within the habitable zones of Centaurus.

And even if the answer is yes, we will not be satisfied, for unless there are technologically advanced Alphans who are willing to communicate with us, the only things we could be missing are a couple of kilometer-long, sea-going dinosaurs.

So all the telescopes we can build will bring us inevitably to uncertainty and frustration; and these are two things that human civilization, as it matures, will not tolerate. Even today, few of us can draw much satisfaction from knowing what science fiction writers seem to have known all along: that the stars may be swarming with planets. Like creatures following some deeply placed homing instinct, we are driven to find some reasonable assurance that we can get there from here, and step out and have a look around.

Getting There

For some months now, we have been conducting brainstorming sessions on the next seventy years in space. Our pet project during these sessions has been planning for a manned mission to Alpha Centauri using antimatter propulsion. The rocket itself will weigh about twice as much as the space shuttle, and will carry a man and a woman on a two-way flight. Cruising speed will be 70 to 92 percent the speed of light, reached by gradual acceleration of 2-g (which simulates about twice the gravity you are presently feeling). The final approach to Alpha Centauri involves a six-month long, 2-g deceleration. This part of the flight will be frustrating, for the closer you get to your destination, the more fascinated you become and the slower you go.

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Nevertheless, during the Cruise Phase of flight, relativistic effects (specifically time dilation) are significant. One result of this is that a 31-year-old man who leaves a 27-year-old brother on Earth, accelerates up to 92% the speed of light, decelerates to a landing in the Alpha Centauri system and stays there for a year before heading back, will have aged six years by the time he lands on Earth. He will find that his younger brother is now three years his senior. Both men have conflicting views of the time that has elapsed; and yet, both views are correct. This is because time is elastic. It can be stretched out by motion (and by gravitation) or compressed by the lack of it. Our experience of time depends wholly on where we happen to be sitting and watching from.

This excerpt from a fictional diary illustrates what travel at relativistic speed will be like:

19 December 2051—We are hurtling through space so quickly that a large hole has opened up behind us and grown to consume two-thirds of the sky. The sun we leave behind has been pulled into our forward field of vision. The whole universe is compressed into a dome-shaped window ahead of the ship. Near its rim, x-rays from the sun have been stretched out into longer, visible wavelengths of light. Directly ahead, near the dome's center the normally invisible infrared of Centaurus is compressed toward the blue end of the spectrum. If the sun were dead center behind us, it would form a perfect ring on the rim of the universe.

Such are the odd realities of relativistic flight. Though we were prepared for these experiences, it is necessary to sail this great ocean between the stars to appreciate its immensity. We are traveling almost as fast as light itself, and we have been doing so for many months; but we have yet to cross even half the distance that separates the sun from Centaurus. We meet nothing but the same black deeps of space. Even at 275 thousand kilometers per second, the stars remain fixed in the heavens—each so far distant from the others, and from us. Accustomed to watching old science fiction films, where crowds of stars move like fire-flies from the center to the edges of starship bridge screens, we do not rightly judge how profoundly small the proportion of suns is to this vast expanse of empty space. The unmoving stars give testimony to the long light years that remain ahead. . . .

If we are determined to travel to the stars, then the above entry is how we must experience the trip.

While nothing in science or engineering should ever be called impossible—*hyperspace*, the ability to step out of the four dimensions of spacetime and take a grandstand view of the universe—comes close to it. We will probably have to satisfy ourselves with relativistic flight and time dilation; which, when you come to think of it, is satisfying enough.

Granted, owing to the fact that enormous amounts of energy must be expended to accelerate each kilogram of the ship's mass close to the speed of light, and then to decelerate it down again, living conditions are bound to be

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a little cramped. Granted that, even by the standard of ship-travel-time, a trip from here to Centaurus will take more than two years each way. But these conditions are nothing people have not lived with before, aboard *Endeavor*, *Beagle*, and *Bounty*. It is nothing people aren't doing today aboard *Salyut*, or planning to do on their way to the Martian wilderness. Bear in mind also that our first real Trekkers will probably be married couples, scientist/authors, compulsive explorers and communicators flying in a ship whose memory holds every book, journal, and movie ever produced. *They are not likely to get bored.*

To be light years from Earth, free of interruptions from supervisors, students, mailmen, attorneys, and accountants—free to get up in the morning and say, "Gee, what do I feel like exploring for the next few weeks?" To the true scientist or the true artist, that is called HEAVEN.

The Ultimate Rocket Fuel

Every time the space shuttle lifts off, a little bit of its mass disappears from the universe. As hundreds of tons of oxygen, hydrogen, and solid propellants burn, a few parts per billion of its mass are converted into energy; that is what all the bright light and noise are about.

In today's nuclear reactors, neutron-emitting heavy metals are making the conversion more efficiently: up to a few parts per thousand.

In a hydrogen bomb, the conversion ratio is almost one percent, meaning that a little bit of matter can be used to release an extraordinary amount of energy. This is why Manhattan Island—the whole thing—can be flash fried by a bomb no bigger than a television set.

If hydrogen fusion were as easy to control as the burning of chemical propellants (we are working on it), the space shuttle could be lifted to orbit on a quantity of fuel small enough to be contained in a beer can.

Antihydrogen is more powerful yet. It differs from normal hydrogen in having a positively charged electron (positron) and a negatively charged proton (antiproton). When an antihydrogen atom is brought into contact with normal matter, one-hundred percent of its mass is converted into energy, along with an equal mass of normal matter. For this reason, you cannot simply fill a shuttle tank with antihydrogen and let it slosh around inside.

At present, anti-hydrogen made by accelerator-target reactions is captured and stored as a magnetically confined circulating beam of anti-protons in high vacuum storage rings. This approach is not practical (the storage system would weigh far too much) for an interstellar voyage.

The only storage method that has a hope of working is solid anti-hydrogen, supercooled within one degree of absolute zero (1 Kelvin). At this temperature, it is solid with an extremely low evaporation rate.

Particles of solid anti-hydrogen would be suspended and held away from walls, probably by electrostatic forces and/or magnetism. It has been conjectured that near 0.0005 K, antihydrogen may be stable enough that it can be stored mixed together with matter, because the wave functions do not overlap enough to pro-

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duce an appreciable reaction, at least in principle. (And in practice? We do not know. It has not been practiced yet, and can only be verified by experimentation.)

For propulsion purposes, one of the safest and easiest designs combines antihydrogen with ordinary hydrogen. Upon contact, antiprotons and protons self-annihilate to produce three varieties of elementary particles called pi mesons:

1. Neutral pi mesons comprise 30% of the proton-antiproton reaction products. They decay immediately into gamma rays.

2. Positively charged pi mesons, traveling near the speed of light, decay into positively charged mu mesons (muons) and neutrinos after flying, on average, only 21 meters. The muons last several microseconds (almost two kilometers) before decaying into positively charged electrons and neutrinos.

3. Negatively charged pi mesons behave the same way positive ones do, except that the resulting muons and electrons are negatively charged.

The charged *pions* and *muons* are the particles we want, and we would like to "catch" the pions before a significant fraction have traveled 21 meters and shed part of their energy as useless neutrinos. Pions and muons can be ejected from the ship along a diverging magnetic field nozzle to produce thrust. Since the particles are acting only against a magnetic field, they can propel the ship without ablating or wearing down the engine (as does space shuttle propellant, with the result that the engines must be rebuilt after every flight, and eventually thrown away). However, gamma rays emitted by the decay of neutral pions will knock atoms out of position in structures near the antimatter reaction zones, making the material stronger, yet brittle. One solution is to weave these structures from hundreds of filaments, and then to send electric currents through the filaments, heating them, one at a time, to several hundred degress below their melting point. Gamma ray displacements in the wires are thus rearranged, and the atoms can reestablish their normal positions.[2]

The gamma ray flare from the engine dictates other major features of ship design. In particular, it has caused us to turn rocketry inside out.

Riding an antimatter rocket is like riding a giant neutron bomb. An unshielded man standing a hundred kilometers away from the engine will receive a lethal dose of gamma radiation within milliseconds. If we choose to design antimatter rockets in the tradition of the Saturn V or the space shuttle, with the engines sticking out the back, we will be required to put several meters of solid tungsten shielding between the engine and the cockpit, plus many tons of equipment to cool the tungsten as it intercepts the gamma rays. We will also be required to carry added fuel, and to burn it more violently, just to carry those many tons of shielding and cooling equipment.

In designing spacecraft, even when considering a propellant as efficient as

[2] There appears to be nothing we can do about the occasional transmutations of atoms into other elements. Fly far enough with your engines burning at full throttle, and your ship will turn slowly into gold, plus lithium, plus arsenic, plus chlorine, plus . . .

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antimatter, RULE NUMBER ONE is to keep the mass of the ship as low as possible. Even an added gram means added fuel, which means extra equipment to store and maintain the fuel, which means extra grams, and so on.

Here's how we can dump many tons of tungsten shielding overboard.

Put the engine up front and carry the crew compartment ten kilometers behind the engine, on the end of a tether. Let the engine pull the ship along, much like a motorboat pulling a water skier, and let the distance between the gamma-ray source and the crew compartment, as the rays stream out in every direction, provide part of the gamma-ray protection—with almost no weight penalty at all. We can easily direct the pion/muon thrust around the tether and its supporting structures, and we can strap a tiny block of tungsten to the tether, about 100 meters behind the engine. Gamma rays are attenuated by a factor of ten for every two centimeters of tungsten they pass through. Therefore, a block of tungsten twenty centimeters deep will reduce the gamma dose to anything behind it by a factor of ten-to-the-tenth power (10^{10}). An important shielding advantage provided by a ten-kilometer-long tether is that, by locating the tungsten shield 100 times closer to the engine than the crew, the diameter of the shield need be only one-hundredth the diameter of the gamma-ray shadow we want to cast over the crew compartment. *The weight of the shielding system then becomes trivial.*

The tether system requires that elements of the ship must be designed to climb "up" and "down" the lines, somewhat like elevators on tracks.

We can even locate the hydrogen between the tungsten shadow shield and the antihydrogen, to provide even more shielding for both the crew and the antihydrogen.

There is an irony involved in this configuration. Our "inside out" rocket, the most highly-evolved rocket yet conceived, is nothing new. We have simply come full circle and rediscovered Robert Goddard's original rocket configuration; with the engine ahead of the fuel tanks and the fuel tanks ahead of the payload.

Droplets and Pancakes and Gas—Oh, My!

Cold empty space is neither entirely cold nor empty. According to the latest estimates of our galaxy's contents, every cubic centimeter or thimblefull of interstellar space contains about *ten* hydrogen atoms. This may not sound like a great deal; until you try to imagine accelerating a spacecraft through space at fifty percent the speed of light and learn that every square centimeter of your ship's nose is impacting against 150×10^9 atoms per second. Although the atom density in space is only about 10^{22} of the atom density of water (that is, a square centimeter of the ship's nose would have to fly through space at half the speed of light for 150,000 years before it encountered the number of atoms found in a thimblefull of water), it is still a force to be reckoned with; because flying through space at relativistic speeds is like looking into a particle accelerator. Every proton has a sting, and every large molecule or "dust grain" begins

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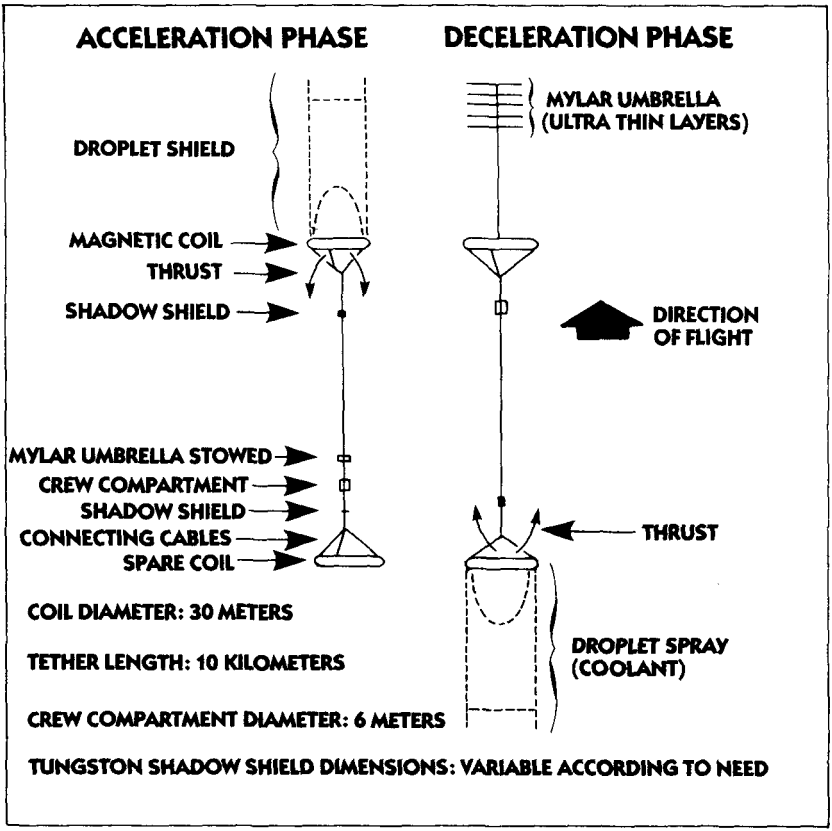

Matter -antimatter annihilation powers this manned, interstellar craft designed at Brookhaven National Laboratory (affectionately nicknamed JEDI Project). Upon arrival in another star system, the crew compartment, a spacecraft in its own right, detaches from the rest of the ship to land on one or more target planets. Life support must operate on a closed-ecosystem basis and be capable of supporting the crew for several years, in the event that they must await rescue by a future expedition.

to look like a stick of dynamite. In addition to shielding against these particles, we have to consider getting rid of whatever energy from the matter-antimatter reaction zones shines onto the coil and tether.

There is a system that can perform both services, at least during the Acceleration and Coast Phases of flight. We can dump intercepted energy into a fluid and throw streams of hot droplets out ahead of the ship. The droplets radiate their heat load into space before the ship accelerates into them and re-

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captures them in magnetic funnels (Ferrofluid droplets may be used to facilitate magnetic guiding and capture). These same droplets can ionize neutral interstellar hydrogen and helium atoms passing through them, with the result that the rocket itself will only encounter separate, charged protons and electrons —which can be thrown off to either side by a magnetic field, much the same way that the prow of a boat shunts water.

Fortunately, whole molecules and interstellar dust grains are much rarer than individual atoms. Almost all of these larger particles are fewer than twenty microns across (10,000 microns = 1 centimeter), and we should encounter no more than one per day per square meter of the ship's flight path profile. When a dust grain impacts against the droplets, the particles in the grain will react as individual particles. They will not "know" that they are part of anything else. Hence, as they penetrate the droplet, each particle will be scattered at a certain angle, and the angle of scatter should increase as the particles pass through more and more droplets, resulting in a spreading shower effect. Again, charged protons and electrons will be shunted away, and we need only worry about expelling heat from the few uncharged particles that get through and deposit in the ship's nose . . . we expel heat on droplets.

One great thing about a droplet shield is that it is constantly renewing itself. Put a dent in it and the cavity is immediately filled by outrushing spray.

If a dust grain passes into the shield, many of the shield's droplets will be exploded. Some of the scattered droplet fluid will be absorbed and recovered by surrounding droplets, but some fluid is bound to be hurled out of the droplet stream, which means that we must also add the weight of droplets to be replaced to the ship's initial mass.[3]

In addition to spare droplet fluid, our preliminary designs call for a spare engine. Both engines will be located at opposite ends of the tether. The forward engine pulls the ship along during the Acceleration Phase of flight. It also fires during the Cruise Phase, but only at 1/100,000th of a gravity, keeping the tether taut and permitting recapture of forward-flying droplets. In normal use, the rear engine is turned on only to decelerate the ship, or to maneuver the crew compartment into the center of the forward shadow. Nudging the crew compartment to one side or the other will be necessary during major course changes, because the crew compartment, much like a water skier, can not turn simultaneously with the motor that pulls it and might otherwise drift out of the protective shadow. A spare engine also provides insurance against the chilling possibility of irreparable damage to the leading engine or, worse, a break in the tether. In the latter case, whichever engine remains attached to the crew compartment can be used to decelerate the ship as it approaches Alpha Centauri. With rearrangement of the ship's components along the tether, the remaining coil can be safely used to finish the outbound leg of the mission, or even

[3] One potential weight saving option is to carry only enough droplet fluid for a one-way trip, and to manufacture new fluid when you reach your destination.

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to chase down and retrieve the lost engine, as long as no *major* course changes are required.

At the end of the Cruise Phase, with nearly half of the ship's fuel exhausted, empty fuel tanks can be ground up into ultrafine dust, for dumping overboard (we see no reason to expend extra energy decelerating tons of equipment no longer in use). At up to *92%* the speed of light, the dust will fly ahead of the decelerating ship, exploding interstellar particles and clearing a temporary path (trajectory must be such that relativistic dust will fly out of the galaxy without passing near stars and detonating in the atmospheres of planets). This fist of relativistic dust is the first line of defense against particles encountered during final approach. With the rear engine firing into the direction of flight, droplet shields will become useful only for expelling heat from the rear engine, for "up" has now become "down," and droplets can only be sprayed "up" behind the engine, where, traveling at uniform speed, they will fall back upon the decelerating ship. To shield against particles ahead of the ship, ultrathin mylar "umbrellas" (thousands of layers deep) must be lowered into the direction of flight. This is the second line of defense—against particles moving into the space behind the fist. The umbrellas, like the rest of the ship, are presumed to be maintained and repaired by small, mouse-like robots capable of climbing up and down tethers and rigging.

Still . . . we can design all the shielding systems we want, and the nagging possibility of finding occasional large particles in interstellar space will not go away. It is a small blessing that the probability of encountering particles of a given size decreases exponentially with linearly increasing volume, but sooner or later, a ship flying near the speed of light is bound to find a one microgram particle in its shield. No larger than a grain of sand (about 100 microns across) it will carry all the destructive force of 100 kilograms of TNT. This is not much of a problem if our droplet shield extends several hundred meters ahead of the ship, but we would still lose a lot of droplet fluid.

We cannot afford to hit too many grains of sand.

And there are bigger traps in waiting; much bigger, if Pellegrino's Pancakes exist. Out there, between the Sun and Alpha Centauri, may lie dust disks with Jupiter-like brown dwarfs at their centers. The dwarf stars themselves are no major hazard to navigation. The danger is the dust that surrounds the stars, rather like the rings and satellites in the plane of Saturn's equator. Although you would have to sift through millions of interstellar grains before you found one weighing a microgram, and billions more before you found one weighing a gram, in a dust disk you will find all the billions of grains you need. The probability of encountering more dust than the shield can handle at one time, and occasional nuggets of ice and ice-rock, thus becomes a statistical certainty. All you have to do is hit a single ice cube at 90% the speed of light, and you might as well be flying headlong into the sun.

Pancakes, if such exist, may become the reefs and shoals of the twenty-first century.

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Watch Your Speed

Light is ageless.

A photon of light emitted from Alpha Centauri A the moment you began reading this paper has now left that star system and is hurrying toward you at 299,274 kilometers per second. Four and one-third years from now, if you happen to be watching from New Zealand's Carter Observatory, it will enter your eye; but for the photon the distance between Alpha Centauri A and your eye will be covered in no time at all. Its 4.3-year trip has, in the relativistic sense, been accomplished instantaneously. The photon "sees" itself leaving Alpha Centauri A and arriving in your eye at the same moment. If, instead of letting the photon enter your eye, you put a mirror in its path and bounce it out of New Zealand and out of the galaxy on a path that will never bring it near any other galaxy, you might draw some gloomy pride from the fact that you can banish the ageless thing so utterly that no one and nothing will ever see it again.

Traveling at light speed, the photon sees the universe aging unthinkably fast. Twenty-billion-light years are nothing—they pass in a flash . . . 30 billion . . . 60 billion . . . the entire future history of the universe—galaxies red-shifting away in every direction.

If, as seems to be the case, there is enough mass in the universe to halt its expansion and draw it back into a big bang, the photon sees the galaxies shifting blue and streaking back almost at the very instant it left a now nonexistent place called New Zealand—and suddenly, there is matter everywhere—so much of it that the photon, wrapped in slowed time and curved space, bouncing from particle to particle, barely makes a meter's progress in one direction in 100 years. The compression of space-time continues until the photon and the particles that once lived in your retina plunge side-by-side into the cosmic singularity, and time itself becomes timeless.

For people traveling in an antimatter rocket at 92% the speed of light, a whole light-year will be covered in only four months. In principle, we can increase the speed beyond 92%, and even approach the time-experience of the photon, but it gets increasingly harder to add on each little percent of velocity, and then to decelerate down from it. For a trip from here to Alpha Centauri, we would have to use twice the amount of fuel to reach 95% the speed of light as to reach 92% the speed of light, and we would only be cutting three months off the trip.

There are other, more rigid barriers to increased speed. As you go faster, your interactions with interstellar matter become more energetic, which makes 99% close to the absolute limit. Push beyond that and even interstellar hydrogen atoms can kill you. They pass with impunity through any shield we can imagine, then through the walls of the ship, and through you, somewhat like ghostly neutrinos. What makes them different from neutrinos is that everything they pass through heats up, falls

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apart, and generally turns to degenerate matter.

The Fascinating Stuff

One of the aspects that makes antimatter rocket studies so much fun is trying to anticipate what technological options will be available to planners in the second half of the next century. For example, what will be the state of robotics, especially in the field of miniaturization? Superconducting magnets that work at room temperature would be nice to have, but we don't know if they can actually be built, so we must plan alternative designs including and excluding them.

Add to this a few unanticipated surprises. We can possibly keep solid antihydrogen stable with matter at approximately .0005 K, yet getting even warm antihydrogen to react in acceptable proportions with hydrogen presents a problem we never imagined we would have to deal with. At the very instant the two substances begin to react, the resulting heating blasts much of the hydrogen and antihydrogen away from the reaction center, causing the reaction rate to drop. It was previously believed that all you had to do with matter and antimatter was throw them together—*BIG PUFF OF SMOKE*—and you were on your way. One of our brainstorming team members, Brookhaven physicist Hiroshi Takahashi, is fascinated by this new obstacle, because it is similar to puzzles that must be solved if muon-catalyzed fusion reactors are to become practical. One of the things he enjoys most about matter-antimatter engine thought experiments is that they simplify matters when he goes back to his room to work on fusion reactor designs.

On Technological Adulthood and Moral Adolescence: Does *Homo Sapiens* Have the Right Stuff?

The technology for producing antimatter using particle beams—yes, the same particle beam devices proposed for the US-USSR space defense system (popularly known as "Star Wars"), is under development at American, European, and Soviet laboratories. At CERN's 7 kilometer circumference synchrotron near Geneva, Switzerland, antiprotons are produced by firing a high-energy beam of protons into a block of tungsten. A trillion (10^{12}) antiprotons can be created in this way. A trillion antiprotons may sound like a lot, but they contain the potential annihilation energy of only 300 joules (roughly equivalent to the "bang" from a cap gun), and the CERN facility gets slapped with a 40 thousand dollar electric bill every time the accelerator is turned on.

Clearly, simpler and more efficient accelerators are needed. Machines with the proper requirements are presently under intensive development in the United States and the Soviet Union for use in fusion reactor research and particle beam weapons design.

"As an example," explains physicist George Mueller, "in one design being studied, the particle accelerator will produce short bursts of protons with a power beam of 10^{14} watts, about 100 times the present power output of the entire world! Of course, since the machine will be operated in 10^{-8} second bursts, the average power is very much lower. As particle beam weapons are deployed for space defense systems, the technology will come into being to make particle generators that have the capability to create significant amounts of

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antimatter, and there is no reason why such machines could not be engineered to run continuously as antimatter factories.

"The natural location for antimatter factories, in view of their large power requirements, is in space where continuous solar power is available. Using the solar flux at the Earth's distance from the Sun, a light collector about 300 kilometers on a side could provide the power for a 10^{14}-watt factory. If the efficiency of antiproton production from each high-energy proton in the initial beam could be made as high as 0.1%, then this machine would produce 10^{20} antiprotons per second, or about one kilogram of antimatter per month."

From our earliest brainstorming sessions emerged proposals for a solar panel array, in orbit around Earth, covering an area in excess of 10,000 square kilometers. Even if it should one day become economically feasible to mine, refine, and transport building materials from the Moon to Earth orbit, such an array would literally become a gigantic solar sail, requiring rockets to prevent it from blowing away on the solar wind.

Our attention turned elsewhere, to a power source firmly anchored, yet overlooked, perhaps because it is so large that no one noticed it before. If we are correct, the planet Mercury is destined to become the most valuable piece of real estate in the solar system.

Presently, we are eyeing self-replicating solar panel building machines. Prototypes will probably be tested on the Moon near 2010. Using the materials available at the lunar surface, they will build solar panel farms, and new solar panel-building machines. In time, the farms will girdle the Moon's equator to form the Asimov Array (named after an early contributor to the concept). The Asimov Array will provide power for the Earth. However, we dare not use that power for producing and storing antimatter on the Moon, or anywhere near Earth, because even a single kilogram of the stuff—a mere handful—carries the explosive potential of forty hydrogen bombs, along with the moral responsibilities that go hand-in-hand with the possession of such power.

Once perfected, descendants of the original Asimov Array robots can be sent like a viral infection to Mercury. Assembling replicas of themselves from the substance of their host, their first half decade of habitation will be a latent, incubation phase, during which most of the solar panels manufactured by the machines will be used to power an ever-accelerating chain reaction of machines building more self-replicating machines. As their population approaches a predetermined critical density, more and more of them cease reproduction and join to form solar panel factories, with the result that almost three decades after the arrival of the original twenty machines, uncountable square kilometers of Mercury's surface will become a gigantic photovoltaic generator, with an area the size of Rhode Island being added daily.

When Mercury is farthest from the Sun, each solar panel will receive 6.7 times as much solar energy as it would receive on the surface of the Moon. This figure rises to fully ten times the lunar surface value as the planet's eccentric

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orbit dips 24 million kilometers nearer the Sun. In time, self-replicating machines will carpet the Mercurian landscape from pole to pole with solar panels, giving mankind more than 50,000 times the present U.S. electrical energy budget—just to play with.

Using self-replicators, the world's future energy problems can be solved for a very small initial investment: the transportation costs of as few as three groups of ten machines to Mercury. Of course, we should not trouble ourselves to begin immediate development of the machines. They would be too expensive to build today, and too inefficient if built from equipment now at hand—just as a trans-Atlantic airline service and video cassette recorders, though technologically feasible, would have been prohibitively expensive to build in 1925. We must wait, not only for technology to catch up with the idea, but for the idea to become economically viable.

And if Earthly sapience lives up to its name, we may live to see raw energy emerging from Mercury as brilliant hairline spokes, spreading 400 meters wide through the intervening 4.7-light minutes to the Moon's north pole.

On the Moon, a cylindrical tower catches the rays, then relays them—thin again—to hundreds of little receiving and storage stations on every continent on Earth. One beam is thrown past the Earth and into the night beyond, where, an hour and a quarter later, its photons intercept a laser sailing ship as it rounds Saturn in an Earth-facing direction. When antimatter rockets are new, we should still be using sails—an image that begins to look like Earth during the emergence of steamships. For months, the parachute-shaped robot explorer has been lofted up and up and up on a shaft of green light. Now, gravitationally bound to Saturn, the wind from the Moon will slow it every time its orbit swings toward Earth, causing the vessel to decelerate, to spiral down toward the rings and its target, Titan. Soon—very soon—a lander will be dispatched to join the fleet of robot helicopters and submarines that move busily to and fro beneath the orange haze. In time, the robots will fill the lander's freezer chest with Titan collectables, and solid propellants will boost the chest back to the sailing ship, which will in turn be laser boosted up over Saturn, repeatedly, until it breaks free and begins its long fall to Earth.

Nearer the lunar relay stations, floating almost directly over the Crater Clarke at latitude 0°, longitude 180°, are history's first man-rated antihydrogen rockets. One of them, the *Beagle*, has just completed her twelth unmanned test flight out to a distance of thirty-light seconds. Her tanks, nearly empty now, are supercooled within one fifty-thousandth of a degree of absolute zero; the coldest places in the galaxy are of human origin.

Light months away, riding on the frontiers of the night, unmanned antimatter rockets are ferrying descendents of the OPEC-Yamasaki-NASA-CCCP Asimov Array robots to Epsilon Eridani and Tau Ceti, seeking only the innermost, Mercury-like planets of those solar systems. When manned expeditions follow, they need not carry antihydrogen for the return trip, as fuel depots

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will already be waiting for them.[4]

What you have just read is a mere glimpse of a future that we *can* have, if we are wise, and if we pay attention. The power that self-replicating robots, the Asimov Array, and antimatter will put in our hands can be put to enormous good, or it can be abused. A few clean sweeps of a beam from Mercury could melt the Soviet Union down to a depth of several centimeters. Surely, the Soviets would never let us build such a thing unless they were able to build and operate it right along with us, as equal partners.

Impossible, you say?

Maybe. But the point remains that if you think we are having difficulty dealing with the thermonuclear inverse to the golden rule, today's arsenals will look like little leagues against to the power we may possess forty years down the line.

With any luck at all, our ascent from Earth will be guided by civilization rather than territorial passions, and self-replicating robots will be working on the Moon near 2010. The robots and all that their existence portends may become one of the most powerful arguments for international cooperation toward lunar industrialization.

Can we do that? Can we learn to live and work with our enemies in space?

Stranger things have happened. Forty years ago, America and Japan were a very poor advertisement for brotherly love—yet look at us today. There are other good signs. Antarctica is now international territory, where Soviet and American researchers visit each other's camps on a regular basis. A piece of American equipment has been accepted aboard a Soviet spacecraft that will lead a flotilla of European and Japanese robots to Halley's Comet. Compatible docking and communications equipment are about to be incorporated into a new generation of U.S. and Soviet space stations, permitting a mutual space rescue capability.

Indeed, there are hints that our wisdom is beginning to catch up with our technological adulthood—and that we, as a space-faring species, can have a future. ■

[4] To get a feeling for what this means, consider the ballooning proportions of jet aircraft if they were required to carry fuel for the return trip from New York to Paris. The ship's mass can be further reduced by carrying only enough normal hydrogen for a one-way trip. Hydrogen, tied up in ice, is "ubiquitous" in space. Hence, finding propellant for the flight home should not be difficult.

ADDITIONAL READING

The authors will be publishing further reports on antimatter propulsion in the Journal of British Interplanetary Society, and in their forthcoming book, *Flying to Valhalla*. Virtually all references on this subject are to be found in the JBIS. Pellegrino and Powell will be speaking at a symposium on Interstellar Travel and Communication to be held at the American Association for the Advancement of Science Annual Meeting in Philadelphia, May 25-30, 1986. Other panel members include Robert Jastrow, William Newman, Jill Tarter, John Rather, Robert L. Forward and Isaac Asimov.

ABOUT THE AUTHORS

Dr. James R. Powell is presently Head of the Nuclear Systems Division of the Department of Nuclear Energy at Brookhaven National Laboratory. He is responsible for work on advanced nuclear reactor and accelerator systems. He has made many important contributions in the fields of fission reactors, fusion technology, applied superconductivity, and energy systems.

Dr. Charles R. Pellegrino is a paleontologist/astrobiologist and Fellow of the British Interplanetary Society. He recently completed PhD work at the Victoria University in New Zealand, where he was a lecturer at the Carter National Observatory. He is the author of 3 books on space science—Darwin's Universe: Origins and Crisis in the History of Life; Time Gate: Hurtling Back Through History *(1985), and* Chariots For Apollo *(1985).*

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on gaming

Matthew J. Costello

World War III is, one might say, in vogue. A surprising number of games have appeared, with more on the way, that feature a world cataclysm as their theme. Game Designer's Workshop has their excellent *Third World War* series as well as their grisly post-holocaust role-playing game, *Twilight 2000*. Dana Lombardy has created *4th Reich*, an entertainingly bizarre game for Task Force Games. Victory Games has given the coming conflagration serious thought in their *The Next War*. Then there's *Nuclear Armageddon* which at least doesn't make any bones about what it's all about.

But for an all-around, pretzel-munching good time while destroying what's left of this battered planet, *Supremacy* (Supremacy Games Inc. $36) wins hands down. Despite its sobering subject matter, namely world domination in the nuclear age, *Supremacy* is an instant classic. Consider it a new-wave *Risk* completely in tune with contemporary war mongering.

The game features highly attractive components. The board is a representation of the world depicted in a stylized fashion. This is the world as pictured on one of NORAD'S computer screens. But it's gussied up with bright colors for the superpowers, a clear turn-sequence display, and a chart to record the current market prices for oil, grain, and minerals.

Armies are delicate plastic squares that match the bold colors of the owning country, and the navies are an art deco-ish oblong. There's a big pile of money, ranging from one billion dollar bills to one million dollar denominations, which fuels this incredibly fast-paced game. Small black markers keep track of each player's current holdings in the three major supply categories (oil, grain, and minerals) as well as Nukes and L-Stars. All of this is recorded on a top-notch player card that tells you the cost of buying forces and moving them. A deck of resource cards lists the production potential of each territory on the board.

And the rules! Well, get Granny out of the closet 'cause even she'll be able to follow this game. While a subtle game with its many features intertwined, *Supremacy* in its basic form is easily picked up and played. Two glossy plastic trays help you keep track of all the money and pieces.

A player's turn consists of the following easy-to-follow steps. A player must pay salaries for armies and resources, then transfer the production value of the resources to each player's Supply Center card. Then the player can sell all, some, or none of the supply units. An interesting touch is that when a player sells any units, say oil for instance, the price drops. Likewise, buying sends the price up.

A player can then attack, if adjacent to opposing armies, move armies and

(continued on page 174)

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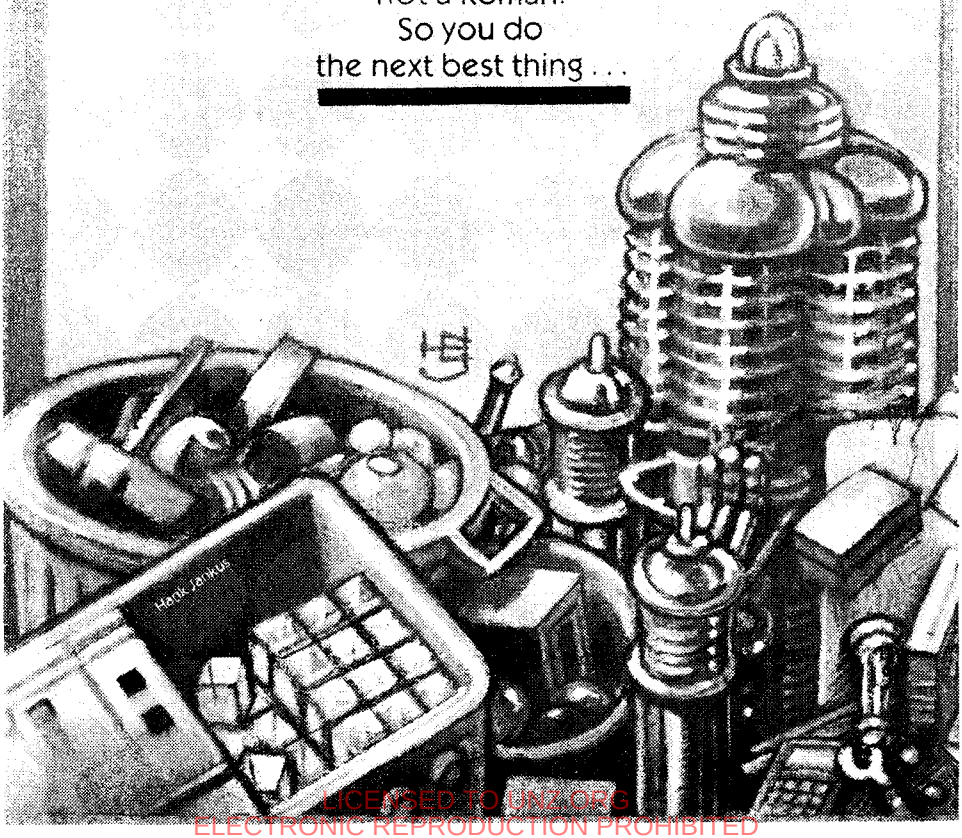
Shelley Frier

PLAGIARTECH

"When in Rome . . ." can be
difficult if you're
not a Roman.
So you do
the next best thing . . .



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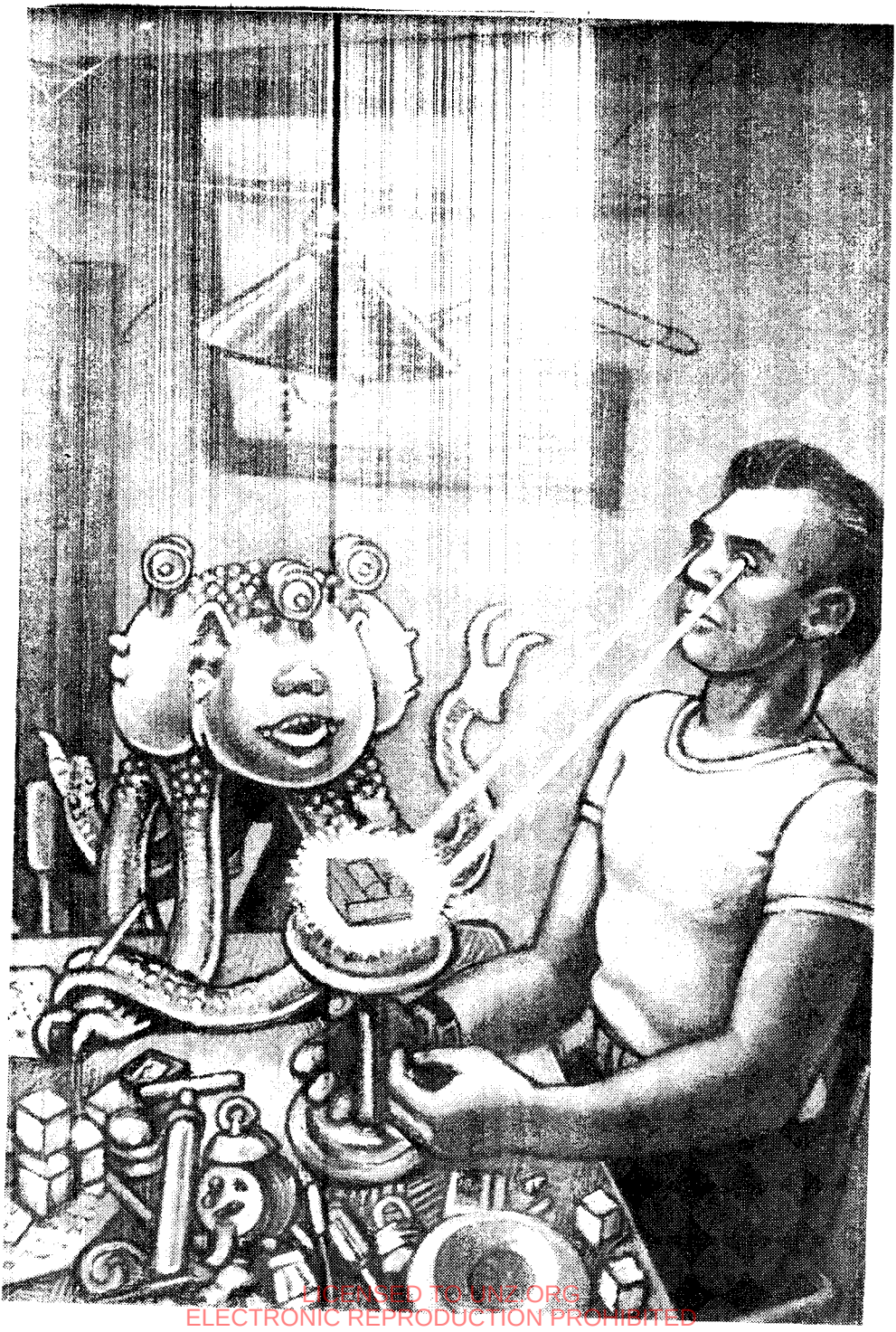

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Ipk was so happy he couldn't stand it. "Oh, how thrilling. How positively de-*light*ful!" Quiet, obedient Mort Lamet stood by, the unfeeling recipient of all Ipk's gushing. Ipk rolled around the room on all six tentacles like a shallowly spinning plate, sucking air into one mouth and snorting it out another while with a third he continued, "How pure. How absolutely stark, simple . . . *primitive!* Like so many things, my unborn progeny, so many *many* things yes?—a female's body surrounding warm eggs until they are ready to protrude, atmosphere blanketing a world until its inhabitants are prepared to venture forth and—er, yes!—yes, and ready to *make their mark* on the galaxy!" Snorting, he scooted back to the table and went for the pencil lying under Mort Lamet's humanoid gaze. "You are wonderful, Mort Lamet. And your creator is wonderfuller still." He poked himself and dropped the pencil. "Ouch! Don't injure the father of yet-unborn children," he chided the pencil.

". . . But no, this it is, it must remain sharp for that's the whole—er, yes!—yes, that's the whole *point!*" He made another circuit of the room, beside himself with glee. "Index this, dearest Mort, along with the rest of my notes from today, and I will prepare me something to eat."

While Ipk scuttled to the food synthesizer and set it gurgling and chuckling almost like Ipk himself, Mort Lamet placed the day's first gadget—the innards of a music box—on a pedestal. One finger poked into Ipk's verbal note cube to record it, while Mort turned his eyeballs around to their laser side and slowly rotated the pedestal, holographing the tiny brass spokes that played "The Blue Danube."

"A lovely little device really," Ipk commented from behind the food synthesizer, "—though limited. It comes in a cloth-lined box and accompanies gifts of adornment, I believe—or is it for members of a major religious sect . . . ? No matter," he proclaimed, stuffing food into one of his mouths, "I've got it all down in my notes. There will be a market for it somewhere—and if not we can *still* live fat and well off the Afro pick, hmmm? Worth—er, yes!—yes, worth *combing* the galaxy just to find a cheap method to harvest the stringy gorph plant! Ah, Mort-me-love, ugly you are, with that mop of hair unknown in known space—but unknown Earth's ugly humans will make me much in royalties. We pierce the bulb with our pick and pull all the stringy gorph through its tines—out it comes, dear Mort, pristine and untangled in one-tenth the time. Ekros Five will love me! My wealthy progeny will love me! Ah, to be so loved, it is my —er, yes!—yes, my *mane* joy!" Mort Lamet said nothing in response, his own innards patiently assimilating the data from this and other gadgets scattered on the cracked linoleum-topped table.

. . . Until it started. The drumbeat from downstairs, disco played on a stereo so loudly, with such a heavy bass, that it threatened to vibrate half the gadgets off the table. BOOM, BOOM, BOOM . . . one table leg, a millimeter or two shorter than the others, buzzed along with the beat. And Ipk went rigid.

Literally.

Three tentacles—every other one —stiffened and caused him to stand an

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imposing four feet tall. The other three stuck straight out in different directions, their two-fingered tips glistening with acidic venom. Two of his three mouths (including the full one) opened and gurgled a death cry.

"Mort!" he managed with the third mouth, "my ancestral call to war —what's it doing on this world? I'll never get work done like this. Find out who's doing it and *shut them up!*"

Mort Lamet turned his eyeballs back and left the tiny apartment.

He returned in less than two minutes to a blessedly silent room. "Well?" said Ipk from a chair at the sink, where he washed off the venom.

"The mother of the boy who was playing it says it's music. She apologized."

"Music? Will it happen again?"

"I didn't ask." Mort Lamet turned to go back down.

"No, don't bother. Music, you say? Ah my dear android, the future father of his offspring understands why this is a restricted planet. Music? That? It doesn't belong in the same category with the lovely box. Whom are these humans trying to kill?"

He lowered himself back to the floor. "Well, on with it then, old Mort. I received a whole shipment from one of the catalog sources today. Precious stuff—a blade to peel the skin off food, a decorative optical fiber tree, and a device that converts their newspapers to tree logs . . . somehow . . . no matter, it's all in my notes. And look at this." Groping around the table-top with one tentacle he pushed aside a battery-operated fan, a set of handcuffs, a twist-cap bottle, an abacus, a wind-up alarm clock, and a patch of Velcro till he found the zipper. "See this—up and down, closed or open—it closes more tightly than buttons." He fussed with it and snorted. "Though it does have a tendency to get stuck. No matter, sons and daughters and *poqteys* to be, your progenitor will improve on the design for *he* is an inventor. And we will be rich; you will never want for anything no; you will be—er, yes!—yes, you will be full to the *teeth* with food and good sex!"

Just then the music started again. Ipk, who had been partway under the table while his tentacle searched for the zipper, banged his head when he unwillingly stood *en pointe*.

"Mort!" Then the gurgling took over all three of his mouths. Mort gingerly picked up his master and stuck him in the shower under running water. He figured it might drown out the drumbeat in addition to washing off the venom.

Once the music stopped and he could bend his tentacles again, Ipk got out of the shower. "Mort!" he called, drying off. "Ho, Mort!"

The android appeared at the bathroom door.

"Good, you're back. Please dispose of today's items—if you've finished recording them all."

"I have."

Ipk scuttled after him into the main room. He watched as Mort Lamet tossed a package of paper plates, a bound book, a bicycle tire and pump, a set of Venetian blinds, a tube of Krazy Glue, a funnel, a roll of toilet paper, a roll of masking tape, aluminum foil, a combination lock, six different mouse traps,

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some matches, a container of Silly Putty, steel wool, a fork, a three-dollar LCD watch, a melon baller, and a cigarette lighter into a huge garbage can. Ipk fished into the debris and pulled out a transistor radio. "So much *copper* my Mort. No evidence of the room-temperature superconductor and I am shocked. They're otherwise intelligent, from what I gather. Why, I understand they're trying to transmit information with *light* in *glass!* Imagine. . . . Well, go on then—finish up and throw it away. Quite a day's haul, this one, but time to toss it and don't forget to fetch the newspapers from the garbage room." He paused. "Wait a minute, dear Mort Lamet." Deftly he rescued the music box pieces. "We'll put this together and give it to the people downstairs: a peace offering. Perhaps the influence—"

Señora Luisa Garcia opened her door and slipped into the hallway, carefully concealing Nicky's baseball bat in her skirts. She didn't want Nicky or her husband Angel to know where she was going, or why. Angel Garcia always said he didn't believe in violence. For now the music was quiet but her son steamed in the bedroom, and Señora Garcia knew it was just a matter of time before he turned it back on.

What was a man like Lamet doing in these housing projects, anyway? She'd only seen him once or twice before, on her way late to work—it was at least 5:30 A.M. and this tall, smooth-faced white man had been in the elevator when she got on. It was a shame to be making bad neighbors of any color, but the thought of being ordered around in her own home brought acid to her throat.

It was just this: that her boy had saved to buy a stereo system for years, finding work on his own, putting the money into a *bank account* after he laid out for groceries—and then suddenly here it was, with pieces of Styrofoam popcorn still scattered over the bedroom floor. Too new to believe. Too much chrome and red and green blinking lights and dials—all incomprehensible but for the sound that came from the speakers. *That* she could understand, because it was a palpable thing within the apartment. Not unpleasant: most of their neighbors in the apartment projects liked the music. And to see Nicky's face when he bent over the dials, then lay back with his eyes closed . . . Luisa had stood for ten minutes in the half-open doorway, watching her son's face. Such a little thing to make him happy. He was a good boy.

This is what she would tell Mort Lamet? That it was her son's dream and it made him happy? One didn't say such words to a stranger—the silent bat could do her talking. Lamet's door was open, and she heard the music go back on downstairs as she peeked inside.

Ipk had kept the pencil as well, and was examining it more closely when the music started. This time the music was so loud it made his sensitive ears hurt, and all three eyes whirled on their stalks in a reflexive search for live prey. He went rigid, his three mouths blubbering and gurgling, "Death to the Screezits! Death to the Nardv! Death to all Krozho and Whumrae . . ."

Death, alas, to Señora Luisa Garcia.

Mort Lamet heard the commotion and ran back in, but he was too late. Señora

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Garcia lay still twitching on the floor, her eyes and throat torn out and blood making a nasty puddle on the stone tiles. Before anything else Mort Lamet scooped up his creator and dumped him gently into the shower, playing the water full force on his triply blubbering head. Then he went to the other room and tried to mop up the blood.

After a while Nicky switched to Spanish rap music; when the beat changed Ipk stopped blubbering. He flopped out of the bathtub and scuttled through the door, leaving a sixfold trail of water on the floor. Mort looked up when the alien made a strangled noise. "The lady from downstairs," Mort explained.

"Oh, Mort," cried Ipk, "what have I done? Just look at her—a *life* gone!" He collapsed on the floor, his tentacles spread out around him, and commenced to sob. "And no one to mourn her save our own selves, since we cannot expose this, this accident to the authorities—" He sobbed some more. "Oh, Mort, Mort, to have caused such tragedy to an alien being, striking her down in the bloom of her youth, the prime of her savage life—with so random a blow. Whatever will we do with the body?"

"The garbage?" Mort ventured, starting for the big can that was now empty.

"No, dearest Mort. Not the garbage because someone will find it, and question us as neighbors who visited her apartment this evening. And what the Earthly police know, the Restricted Planet Patrol are not long in learning. No, I'm afraid you'll have to dispose of it in secret tonight, when it is quite late. And look—she had even brought us a gift." He picked up the baseball bat. "Ah, my unborn children, you are already sullied with the curse of having a murderous father. How will you live with yourselves?"

After he quieted, and helped put Señora Garcia's body into the trunk where he resided when Mort took him outside, Ipk set himself to composing an appropriately human sendoff for the deceased. So that when it was three A.M. and time for Mort to visit the East River, the android had a speech to recite.

"MYSTERY EAST RIVER DEATH," he intoned softly over the greasy splash, as her body hit the water. "DEAD WOMAN FOUND FLOATING," he continued. "CRUEL DEATH FOR MANHATTAN MOTHER . . . EAST RIVER MOM MOURNED . . . SON: I NEVER SAW HER LEAVE . . . LOVING HUSBAND ACQUITTED . . . D.A.: NO SUSPECTS . . . HUSBAND SWEARS VENGEANCE FOR EAST RIVER MOM."

After he was done, he made his way back to the projects.

Mort went to work the next day as usual, washing dishes for a diner off Second Avenue in the fifties. At 11:00 his boss said to knock off for a half-hour, and he stripped off his gloves and went out the back door.

They'd have thought it strange if he never ate in the diner, so sometimes he fixed himself a sandwich and took it outside. He was programmed to try to fit in—pretty advanced stuff, really. Mort felt proud to be made so well, and feeling proud made him feel even prouder. He slipped down the alley through a canyon of brick brownstones to the next street over, emerging between a computer store and the Smith

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Co. Curio Shop, former home of Ipk's music box and alarm clock among others. This store was not nearly as rich in gadgets as the Woolworth's down the street, but things he bought here seemed to have more . . . character, Ipk said. Ipk liked him to pick something up from the shop occasionally, just to round out the load of very useful, plastic geegaws he brought home every week.

The owner watched him suspiciously from a corner as he held up a kaleidoscope and an antique seltzer bottle and wondered what his chances would be of turning his eyes around behind a shelf somewhere and holographing the objects right there. They were too expensive to buy, considering their minimum potential usefulness as low-tech gadget concepts. But it really wasn't his place to judge, being the android and not the inventor, so he picked them up and walked back to the ancient hulking cash register and the antique shopowner.

Mort got as far as the stacks of old oil paintings and almost past the glass case of rhinestone jewelry when Ipk pressed his recall button. Unable to do anything but return to the Metro North Housing Projects, he set both items on the glass case and walked out, leaving the owner to glare after him. This had to be important—important enough to let Mort lose his job if he didn't show up after lunch. He made haste, as programmed.

Subway was the fastest thing up there, provided it ran. Mort sprinted to 51st Street and down into the station, slammed a token in the turnstile, and ran to jam his hand between the closing doors of a Number Six uptown train. The conductor held the doors shut for a minute, challenging Mort to a battle of wills, but eventually he gave in and opened up. Mort slipped inside. A few minutes later he was hurdling the turnstiles in the 103rd Street station.

The only open entrance to the projects was around a concrete wall at a guarded gate, where he had to fish out his key despite the guard sitting right there, waving. Then down a sidewalk that bisected the angle of the double-wing building, into the doors at the angle's vertex (another key), and up the steps at android speed, clearing five at a time. Bursting into the tiny sweatbox of an apartment, he stopped to find Ipk amid a jumble of gadgets and holocubes, pushing objects around and moving nothing into any semblance of order. "Oh, Mort," he cried, "shut the door and aid your poor master. Despite our splendid funeral, the bereaved neighbors have notified the police—who came up and knocked on this door. This very door!" He pushed more junk around. "They didn't come in. Instead I heard something about obtaining a warrant to search. We're going to have to move, my dearest Mort. Move, and change your job and your name. And I shall sleep away my time on this restricted planet inside a dark footlocker in the Grand Central Station, till you find suitable living quarters." Suitable meant cheap. "If something happens to you I shall never wake up. Oh my children, you might never, ever be!"

Mort Lamet had no response. None was called for. In silence he packed the food synthesizer and all Ipk's notes, a few changes of clothing for Mort, and the holocubes into one large suitcase; he packed Ipk and his sleep machine

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into the trunk. From underneath the mattress he took their store of cash —easy to save since Mort worked two jobs and didn't eat; he only bought the geegaws and sometimes managed to take them back when Ipk was done. He would need the money to rent a new place. He checked the hallway, then walked to the other end and took the fire stairs. Mort rode the Number Six back down to Grand Central Station, and checked Ipk and his luggage into two large lockers.

Three days later, he had a two-room apartment in the Phipps Houses, projects on West 64th Street. They were old railroad flats and in worse condition than anything else he'd seen—but one was available and he took it, signing the lease as Tomm Taler. Two days after that he had one job at an all-night Howard Johnson's in the red light district and was looking for another.

Soon everything was back to normal. Ipk moved in. Since HoJo's didn't give rubber gloves, he had Mort-Tomm make slight modifications in his artificial epidermis that caused his hands to turn wrinkled and pink after long immersion in water. Tomm found a second job and went back to bringing gadgets home from the local five and dime and from foreign-owned electronics and Persian rug stores along Fifth Avenue in Midtown.

Ipk nosed into optical fibers some more, though he couldn't understand how they got as far as using light to transmit and still didn't seem to have pictures on their telephones. He also investigated the merits of post-hole diggers, butter churns, slide rules ("de*light*ful!"), wax candles, soap bubble pipes, car cup holders, cork bulletin boards, kitchen sinks, and paper clips.

The only problem was the noise. Now neighbors on both sides had music blaring from the time they got home till they went to bed; and though not everyone always played disco, Ipk spent enough time in rigid battle-readiness to cause him considerable irritation. It got so bad that Tomm Taler had to switch his other job from the better-paid second shift to the day shift, so that he could take care of Ipk while the neighbors were home.

Ipk spent much of his nighttime efforts seeking an end to this misery. "Ah, Mort-Tomm—what will become of me? If I kill anyone else we shall be caught for sure, and then the Restricted Planet Patrol will find me and cart me away, prevent my ever breeding. Oh, me, I am doomed. Doomed!" He gnawed at one of his tentacles, and Tomm looked on with some measure of concern. Since the music and Señora Garcia's unfortunate death Ipk seemed depressed all the time, as though the effort of standing at attention siphoned off some of his former effervescence. He hadn't made a bad pun since they'd left the Metro North Housing Projects —much less a good one. Ipk slumped on the floor, dragging his body across the tiles in a slow-motion version of the old scuttle. "If only I could counteract my reaction to that awful music."

"Or counteract the music you react to—"

"What was that?" Ipk glanced up at the android with one preoccupied eyestalk. "Ah dear Tomm, my so grateful thanks; the cost of summoning a creative suggestion must drain your worthy cells to minimum function. Remind me and

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I shall install an override lest you be caught without energy for the sake of unnecessary innovation—which is my job, in any case." Tomm Taler permitted himself inward recognition of the humor in Ipk's budding jealousy; the six-legged inventor and idea thief certainly *had* outdone himself, indeed. If nothing else, he had a talent for producing advanced-function androids. "But stopping the music is impossible," continued Ipk, "without causing a blackout throughout the building. And these people have *weapons*. My yet-to-be-created progeny, your ancestor is no inventor but a poor foolish dilettante who should be off fathering children instead of wasting his time on barbaric worlds. Oh, me!"

Morosely he pawed through the holocubes on his table, muttering to himself about earplugs and insulation, antitoxin, anti-venin, nerve gas, paralysis rays, energy absorption fields . . .

"What was that, Tomm?"

"I did not perceive outside noise interference—"

"No no no! What was it I just said? Energy—what, yes? Oh, yes? Energy *absorption* fields? Mine shaft vibration absorbers, microwave transformers, yes yes? Dangerous vibrations of specified frequency absorbed completely and bled off as microwaves, harm to none? Oh my. Oh my, yes!" He squealed and snorted, puffed air, blubbered "yes yes yes . . ." all at once, climbing up the table legs and tickling himself with one free tentacle. "Oh Tomm I have solved it," he cried, looking like King Kong on the table leg with another tentacle waving in the air. "As simple as a field generator, microwave transformer —microwaves are harmless to humans, yes Mort-Tomm? And so—"

"No."

Ipk closed all three mouths and let go the leg, falling with a splat. He didn't notice. "Say that again, android of my delight?"

"No."

"No, what?"

"No, microwaves are not necessarily harmless to humans. There have been demonstrated changes in the pulsation rate of ganglionic pacemaker cells during exposure to microwave radiation; it may also cause formation of eye cataracts and changes in the immune function of Earth creatures—"

From three tortured throats rose a wail that could even be heard above the Spanish rap music.

The tiny ship was three or four times the size of Ipk's footlocker. It came out of hyperspace and settled on the back side of Earth's Moon. Wedged into a crater, its occupant set about a routine check of the restricted zone, first dumping information from the beacons that monitored the news media. She'd check this moon and its planet, and then take a quick look 'round the other worlds for illegal mining and such. It was a dangerous business, this patrol—if the Bureau of Intelligence and Technology projected the advancement levels inaccurately, a patrol could be betrayed in the very act of trapping traitors. The Screezit within the ship engaged her instruments and settled down to wait. If there *was* unauthorized visitation on the third planet, it might take a few days before the visitor betrayed his presence with instrumentation of his own. Only,

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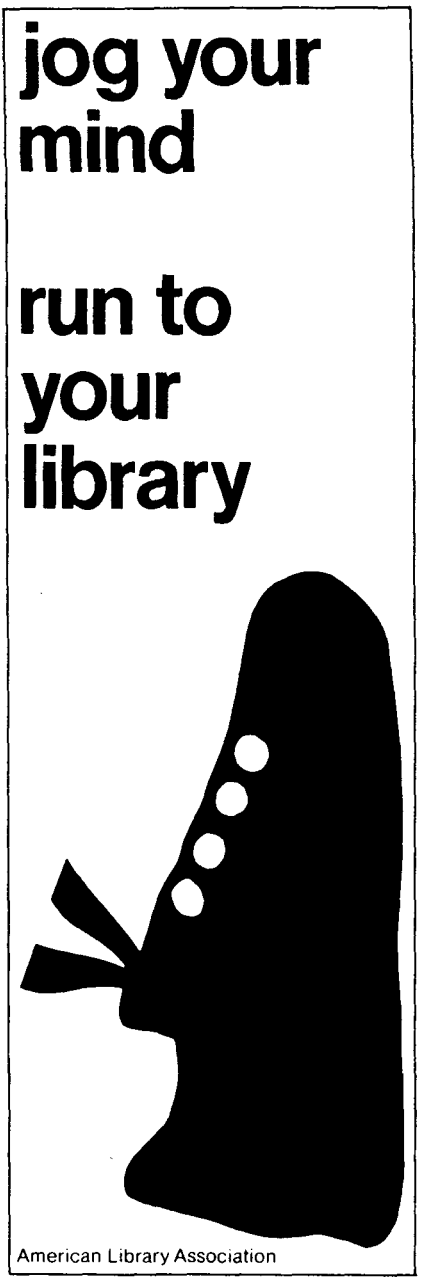
if the natives had surpassed themselves and discovered more than the Bureau guessed—then whose instrumentation would she be detecting?

Ipk flipped, landing on Tomm Taler's shoes. The android set him upright. "A genius, my lucky children!" He scuttled across the floor and hopped on the bed. "I have seen the—er, yes!—yes, the *light* of discovery in the *phone*-omenon of sound!" Ipk snorted and chuckled and jumped up and down, causing all the holocubes to bounce from the bed to the floor. "My dear, delicious, heavenly Tomm . . . do find me the cube on telephones and fiber optics. And then call up your library: that mining device is still the—er, yes!—yes, the *bass*-is of my new invention."

It didn't take long at all, once he got Tomm to take the train and a taxi up to Lake Peekskill, NY, where his small ship was buried. Some of its parts were temporarily cannibalized—most important was the generator that surrounded Ipk's ship with an absorption field, which took in any wave, scanned and duplicated it on the ship's screens, and shot out an identical wave on the other side. The result was invisibility, since observers received any frequency of wave from *behind* the ship. Nothing bounced off.

This was fine-tuned according to instructions in the *Whumra Guide to Mining Engineering* (old feuds had long disappeared; only the reflexive vestiges remained). The devices they used in mines weren't half this precise. With his "invisibility" field he could modify the



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frequency and even program in some pattern recognition, so the thing only responded to a disco beat. And the transforming function . . .

"My field absorbs the wave and duplicates it; the Whumrae's field has no need to duplicate. But theirs must do something with the energy it takes in—so they bleed the energy back off as microwaves. Who among us would bother with light transmission, my children? No one with intelligence and a cheap superconductor to send electricity straight on through, pure as a lover's heart. Better than glass it is, so who would ever think in terms of transmitting light the way these humans do? Until light is *needed*, or wanted anyway as a tradeoff for sound. After all, something *must* be done dear Tomm with all that lovely energy we suck off the sound vibration, and sending it out as microwaves will clearly not do the trick. . . ."

Leroy put down the joint and looked at the wall. He didn't know what was mixed in with his grass, and maybe he didn't want to know. Sitting hunched against his headboard, staring at the other side of the room—the stereo seemed to have gone dead, and in the murky darkness something glowed on the far wall. He changed his mind, picked up the joint again. "Wow," he murmured, "*colors* . . ."

"Aha," cried the Screezit as she took off from her listening-post on the Moon. "That's an absorption field if I ever saw one!" And with only one in evidence, it couldn't possibly belong to the natives. When she got close enough she would disable the field, just in case, before moving in on her culprit. . . .

". . . Yes, and Ziploc bags, and something with snaps, and—what else did I see in that paper? Ah, yes of course: look into buying a vacuum cleaner. They appear expensive, which does not surprise me; yet they may be the answer to our space trash problem. Then hurry home, Tomm. Our mission on this lovely, primitive world is nearly done." Propelling Tomm outside, Ipk stood behind, out of sight from the hallway, then closed and double-locked the door. He scuttled over to the middle of the room, where a silent addition to the decor flashed an amber ready-light. When the rate of the flash increased, Ipk sighed. "Labor away. Oh, my issue. Soon enough I shall leave this place, perhaps to settle down, to marry and marry and start producing something useful, like children—"

The amber light winked out. The song "Beat Me with Your Beat, Beat, Beat" growled and rumbled into the apartment and Ipk froze involuntarily. With a whimper he stood erect, almost weeping as his mouths cursed the enemies of his civilization's youth.

The door burst open. The Screezit stood drawn up to her full meter's height, glanced around the room, entered, and slammed the door. "Fool!" she cried, "what have you done here? This race wasn't to be interfered with for another three tech-unit cycles."

Ipk just stood bewildered and gurgled, "Death to the Screezits?!"—three of his tentacles stuck out rigid, dripping venom, and still he didn't move in on the "enemy" patrolwoman. What was wrong? By now any organic prey should

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have been lying dead—or at least been valiantly defending itself.

"I know your kind," she continued, circling him warily. "You're nothing but a poor unimaginative plagiarist. When this planet comes into the league they'll be cheated out of any trade at all by your pre-emptive thievery." From her pouch she produced a lockup, a small stasis field like the one that put Ipk to sleep in Grand Central Station. "I'm taking you in," she said.

And froze.

The two holes in the back of the Screezit's neck only made themselves known to Ipk when they started to smoke. Tomm Taler, standing in the doorway, managed to stumble blindly into the room, feeling his way because his eyes were turned around, kicking against the absorption field generator and reaching down to switch it back on. "Master," he grunted before collapsing, "I detected the presence of another android in your vicinity. Eeeee-zzz—blah blarrrggh—"

His speech faded to nothing.

Ipk immediately scuttled over and closed the door. "Oh, my. Oh my. Oh dear Tomm Taler I owe you my—my very life!" Gently he turned the eyeballs around, examining them one at a time. The laser mirrors inside, once flat and perfectly suited to the making of holograms, had been heated and curved from within to create a pair of full-strength lasers. "Whoever programmed you to *think* of such a thing? Look at that—a flat mirror, now curved to make a picture-taker into a dangerous weapon. Whence came the energy to curve a flat holography mirror? Whence came the energy for a tight-beam laser? Oh my children, Tomm has burned out his circuits, drained himself to his very core—and all to save your humble father from the clutches of another android, a mock-Screezit who surely would have pressed charges. Ah me, no more holocubes this trip; but we're lucky enough to escape with our freedom, eh Tomm?

There was no response from the android, who had indeed drained himself of power. He would need an overhaul and half a day's recharging. "Maybe it's time we thought of leaving, my darling offspring, and setting about producing you for once and for all." The amber light's rapid blink slowed, and returned to its ready-state: someone had turned off the disco. Ipk patted the field generator and sighed. "Ah—to be served by friends so loyal, yet betrayed by my own ancient reflexes. Am I so unworthy a criminal not to warrant true, living captors? Who will then marry me and marry me, of those organic members of my race? My seed, will we meet *ever* —face to face?"

Ipk's unborn seed gave no more reply than the android. But there would be all the time in the worlds for them to answer, once Ipk settled down to marry and marry and produce many threes of offspring, living off the fat of his thievery.

Just as soon as he packed. ■

● A self-addressed envelope would be addressed "envelope."

Kelvin Throop, III

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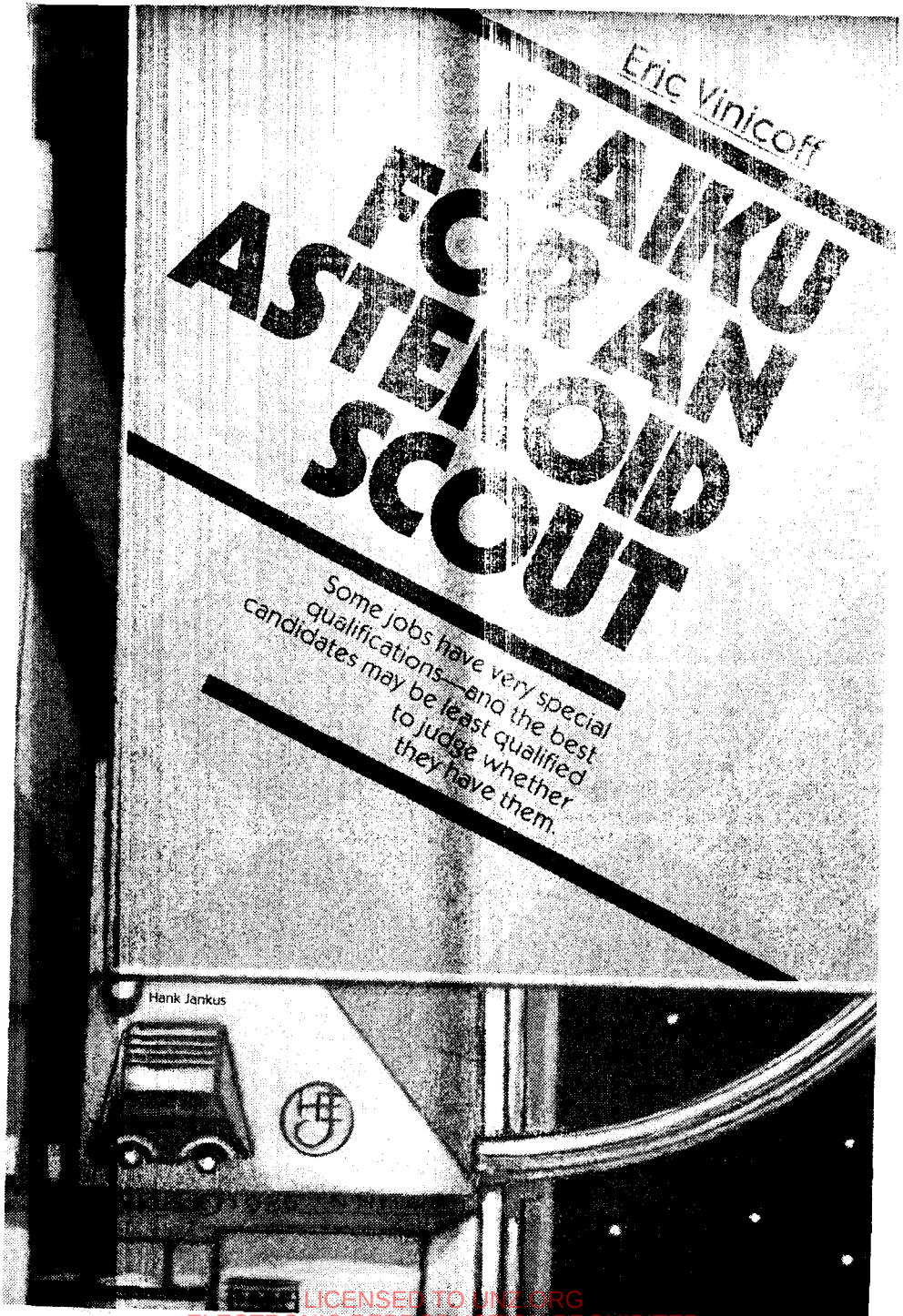
Eric Vinicoff

HANK JANKUS FOR ASTEROID SCOUT

Some jobs have very special qualifications—and the best candidates may be least qualified to judge whether they have them.



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First Line

The annual Career Fair was an important event in Proxima Tokyo. The vast Hall of Trade was brightly lit by glowpanels hung from the high ceiling. Thousands of stockholder-citizens moved among the hundreds of exhibits: students making career decisions, adults considering changes, and visitors from throughout the Alpha Centauri system.

Yoshio Esaki and his classmate Masumi Okawara paused at the entrance by unspoken mutual agreement. They had talked about this day for years. Now that it was here, the reality was frightening.

"We're prime material, I tell you." Masumi had been carrying on an animated one-way conversation all the way over. "Seven hundred plus on our finals, no downchecks—the only question is which of the Eleven Corporations will be lucky enough to acquire our services. Maybe even Prox."

Yoshio nodded. He wasn't nearly as confident as his friend seemed. True, he had worked hard and done well. But he was aiming high. He had wanted to be an asteroid scout for as long as he could remember, because that was what Taro was.

People were walking around them into the hall. "Come on," Yoshio said reluctantly, and they started in.

The exhibits were as spectacular as the sponsoring companies could create, fantasy structures of metal, glass, plastic, and colored rice paper. Holographs extolled the virtues of myriad jobs. People clustered around displays and databoards. The visual impact disoriented them for a moment.

The hall was properly quiet, the only disruptions being soft equipment hums and shoesteps on the mut-grass carpet. Yoshio saw Masumi switch his subvocalizer to the public channel, and he did the same. Sounds poured into him from the earpiece: conversations, music, and come-ons from the nearest exhibits.

They took a walkway that spiraled to the center of the hall. Yoshio drank in all the wonder he could. On the outskirts were local businesses and professions; he saw another classmate, Mie Nishioka, in a med practice exhibit. Then they came to the more lavish exhibits of the system-wide businesses. Among them were many mining companies that he would be visiting later.

The exhibits of the Eleven Corporations were in the center of the hall. They were the biggest of all, and the most crowded. To the glamor of their great wealth and power was added interstellar scope. Their holographs showed gas mines in the atmosphere of Epsilon Eridani VI, exotic flora and fauna on Tau Ceti's Greenworld, even Earth where the waves lapped over Japan-that-was. Yoshio and Masumi left the walkway and entered the Proxima Centauri Corporation's exhibit.

They looked around nervously until a beautiful woman in the red and silver dress uniform of the corporation walked over to them. "Welcome, stockholder-citizens," she said in a way that convinced them she meant it. "I'm Maru Osata. May I be of some service?"

Masumi froze. Yoshio managed to stammer, "Uh . . . yes—"

She smiled reassuringly. "There's nothing to be afraid of, I promise. Let me guess. You both seem about fifteen years old, so you're probably graduating

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students looking for the right careers. Am I right?"

"Yes," they answered in unison.

"And what fields are you interested in?"

"I'm going to be an asteroid scout," Yoshio said firmly.

"I'd like to get into management training," Masumi added.

She nodded. "Wise selections. Let me tell you about the opportunities available in the Proxima Centauri Corporation, and answer any questions you might have."

Ten minutes later Maru took their pocket comps to a databoard, fed their resumes into the corporation's comp net, and handed them back. Yoshio and Masumi thanked her for her assistance. They exchanged bows, then the two students left.

"That was easy," Masumi said as he wiped sweat from his forehead.

"Yes, now that we've done it." Yoshio was already feeling the anxiety that lay ahead. Four more weeks until recruiting day and the revelation of his karma.

One by one they repeated the ritual at the exhibits of the rest of the Eleven Corporations. That much was SOP for all graduating students. Then they headed outward again, following lists stored in their comps, submitting their resumes to carefully selected companies.

By the time they finished the morning was gone. "We'd better get back," Yoshio said. "If we don't boost we'll miss lunch."

"Okay. But did you see the spreads in the restaurant exhibits?"

"Enough plus calories to ground a thousand spacers." Yoshio laughed, feeling the brittle excitement of adrenalin. "Let's get out of here before I become an asteroid instead of a scout."

They joined the flow of people leaving the hall. Outside they switched their subvocalizers back to a two-way, and the sudden quiet was as shocking as the noise had been. The street was busy; cars and trucks rushed by on their fat traction tires. Cherry and spruce trees shaded the walkways. The holographic sky was bright blue with a few fleecy clouds.

They took a walkway to the pubtrans station and squeezed into the next train. It sped through the vacuum tunnels with maglev smoothness. Minutes later they got off at the Child Center station and hurried to the dorm cubic.

"See you at lunch," Masumi said over his shoulder as he headed for his room.

"Okay."

Yoshio walked the familiar corridor to his own room. As the door slid shut behind him, he felt the usual reassurance at being in the one place that was truly his. Though not much longer . . .

He sprawled on the bed and idly played with his slave collar.

"You received a message from SpaceCom at eleven oh seven A.M.," the room phone's pseudovoice announced. "Message follows. Greetings and best wishes, Yoshio. Change in plans. *Polaris* inbound, ETA today. Have reserved table at Mount Fuji for dinner at six. See you there if you can arrange escape. Taro. Message ends."

"Received," he told the phone. Joy bubbled through him: Taro hadn't expected to return from his latest trip for another two weeks. It would be great

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to have him here for the graduation festivities. As for dinner, he figured out a simple three-way duty trade that would free his evening.

Suddenly very tired, he didn't get up right away. He looked around the room. He didn't see the vid wall displaying the red and blue Trifid nebula, or the desk comp almost buried under memory cubes, or the female zock stars fighting with spaceships for the limited poster space. He saw all the other ways the room had looked in the past twelve years, reflections of his younger selves.

A month from now it would begin again for someone else.

He got up abruptly and almost ran to the cafeteria. The others were already eating at Group 1138's table when he sat down with his tray. He switched his subvocalizer to the group channel, and tried to ignore the rude babble of voices coming from the youngest groups. "Sorry I'm late, Mom."

At the head of the table his group mother smiled. "I'm sure you had a good reason. Don't gulp your food —there's no hurry."

"Yes, Mom." He slowed down his rate of ingestion. One of the nineteen chairs was empty. He wondered where Yasuhiro was, but it would have been an intrusion on his privacy to ask.

Everyone was talking about the Career Fair, but skirting the ominous topic of who would be hired by whom. Yoshio arranged the trade with Masumi and Aki, and got Mom's approval. He found himself looking at his classmates the same way he had his room. They had learned, played, and grown together. What would it be like to be apart from them? He couldn't imagine, and that scared him.

After lunch the students went about their individual schedules. Yoshio spent the next two hours working Aki's duty shift on crib row. The ICU's held new stockholder-citizens, shriveled ratlike crying machines fresh from the embryo tanks. He found it hard to believe that he had ever been like that. Even so he enjoyed taking care of them, except for the cleaning.

At three o'clock Group 1138 reunited for *Uchu-giin* History class. Its seminar format was unique; Yoshio's other non-lab classes were comp study where he only saw the teacher when he needed help. It was also unusual in that it often strayed from the comfort of correct answers into debate and even argument.

"We will begin now," the teacher barked, ignoring the empty chair where Yasuhiro should have been. Seijun Yamate had been a samurai in High Lord Okitsu's service before becoming a historian and teacher; he taught with the same fierceness as he fought. "I have an announcement to make that should please you. This is our final meeting."

Everyone became very alert. Yoshio sat up straighter, and rubbed his neck where the slave collar chafed. Did that mean. . . ?

"This is the most important event in your lives," he continued. "It is so important that it occurs without ceremony—you must find your own meaning for it. Masumi, what is the essential difference between we *Uchu-giin* and the *gaikoku* of Earth?"

"Uh . . . we have more self-discipline."

"Exactly. Life in space is much less

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forgiving than on Earth. The smallest mistake or deliberate act can cause disaster. The early attempts to exploit space all failed tragically except for those of Japan-that-was. We succeeded because of our heritage of self-discipline. The years in space have strengthened our spirit even more.

"But we still live on the sword's edge. Children cannot be expected to possess such self-discipline, so they are constantly watched. The remote monitor units enable the comp net to protect them and the community while they learn.

"This course has been a key part, though only a part, of your spiritual education. That you are here today indicates you have been judged ready for the responsibility of full citizenship. You are adults."

Everyone was staring at the empty chair. With a sudden sick feeling Yoshio realized that Yasuhiro had failed the test. He would have had to wear the slave collar for the rest of his life. Few *Uchu-giin* were able to live with such shame.

Yasuhiro had performed *seppuku*.

"You are entitled to all the benefits due stockholder-citizens in the Proxima Centauri Corporation, and subject to all the corporate regulations. Take your remote monitor units in both hands and pull outward."

Yoshio pulled, and the comp net released the lock. The slave collar opened with a click. Hesitantly he removed it from his neck and stared at it. His neck felt strange. His mind was crowded with emotions.

"Stand up. Place your remote monitor units on your chairs."

They did so quickly. Seijun looked from face to face, and grunted. "Spend your lives well. Always remember who and what you are."

The students returned his bow with their first awkward bow-of-adults, then marched out of the room.

Yoshio and Masumi walked back to the dorm cubic together. "Well, stockholder-citizen Esaki, how do you feel?" Masumi asked eagerly.

"Like I've been through a ten-g boost." Yoshio took a deep breath and let it out slowly.

"Too bad about Yasuhiro. I can hardly believe it."

"He gained great honor." The shock of the fact that his classmate had given back the gift was passing. He had been taught to understand death, not grieve over it. He envied Yasuhiro's strength of will, and wondered whether he could do the same if necessary.

Back in his room he took a relaxing bath and put on his best clothes. Then he rode the pubtrans to the Ginza cubic and the Mount Fuji restaurant.

He walked boldly into the lounge area looking for Taro. The bartender robot verified his adult status with the comp net, then bowed to him in welcome.

"Buy you a drink, spacer?" A big hand clamped onto his shoulder and spun him around.

"Father!" He threw his arms around his role-father, then stepped back and regained his self-control.

Taro Todoroki was almost fifty, and a tall, heavily muscled man. They had been paired since Yoshio was two years old. The asteroid scout spent half of his life on trips, so it was very special when he returned.

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He patted Yoshio's neck where the slave collar had been. "Congratulations, son. I never doubted for a moment you would make it. Now, how about that drink?"

Yoshio quickly figured his allowance balance. "You would honor me by letting me buy you one, father."

Taro smiled. "I've never turned down a free drink in my life. Let's sit down."

Yoshio didn't think much of his first bowl of sake, and had no trouble limiting himself to one. "Will Nobuo be joining us?" he asked. Nobuo was Taro's second aboard the two-person scoutship *Polaris*, and his good friend.

"He sends his greetings, and his regrets that he's unable to attend. I'll explain why later. I see our table is ready."

The dinner was very good, and for Yoshio it passed in a happy glow. He talked about the Career Fair and how well he had done on his finals. Taro talked about his latest trip.

After dessert, as they sipped the last of their tea, Taro took a gift-wrapped package from his belt pouch and handed it to Yoshio. "A graduation present, son. I hope you like it."

Yoshio tore away the wrappings. It was a Nippon Electronics AK6 pocket infotrieve, the absolute top-of-the-line. "Oh, father, it's wonderful! Thank you!"

"Go ahead, try it out. Your first month of comp net service is already paid for." Taro leaned back in his chair.

Where to start? Yoshio switched his subvocalizer to its channel and asked for the score of tonight's Whalers game. "The Proxima Tokyo Whalers lead the Proxima Osaka White Sox three to one in the top of the eighth inning," the pseudovoice reported.

Buoyed by the good news he asked for the current population of Proxima Tokyo (106,228), *Polaris*'s berth (Belt Mining Company number eleven), and the technical data for building a fusion mining charge (classified, not available without proper clearance code).

He asked for an outside view of Proxima Tokyo. The tiny holotank filled up with a background of space, stars, and a red dot that was Proxima Centauri. In the foreground was his home city, a spinning cylinder of bright silver alloy. As he watched a passenger liner shot out of the accel/decel shaft opening at one end.

He didn't bother with the other cities; they all looked the same. Instead he asked for a view of the interstellar launcher. Of course it wasn't possible to fit over a hundred accelerator rings spanning thousands of kilometers of space into one small image. He saw the interstellar port, a miniature version of Proxima Tokyo, and behind it the twelve kilometer parabolic antenna that received interstellar laser pulses.

He realized he was being rude, and put the infotrieve away in his shirt pocket. "It's great. Thanks again."

"You're most welcome." Taro paused. "If you can drag your thoughts from your new toy for a moment, I want to discuss something with you."

He recognized the no-nonsense tone that Taro used aboard ship. "Yes, father."

"You're probably wondering why I inbounded early. Well, there's a bit of an emergency on. *Polaris* is being fitted with a special radar and spectroscope

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—I'll be boosting again tomorrow morning."

Yoshio's stomach knotted. Taro was leaving! He wouldn't be here for graduation, or recruiting day.

"Wipe that dead-fish expression off your face, son. I'll only be out for twenty days or so. Moreover," he smiled, "how would you like to come along as my second?"

"What!" Yoshio was so excited he almost shouted aloud and shamed them both; the restaurant was crowded with diners. "You mean it? What about Nobuo?"

"Yes, I mean it. Nobuo has been promoted—he boosts tomorrow as the captain of *Rigel*, thanks to the emergency. Every available ship is outbounding. We're short on experienced scouts, so when I pointed out your two student trips aboard *Polaris* I got permission to sign you for temporary duty. How about it?"

He would miss graduation and the parties, but he would be back in time for recruiting day. And serving as second on a scout trip, even a short one, would have to be good for his career. But the most important thing was that Taro wanted him as his second. "Yes, father. And thanks."

"Glad to have you aboard."

"You mentioned an emergency, father. What is it?"

"Forget you heard me say that. Sealed orders until we boost. Now, since we only have one night in port we'll have to make the most of it. Come on."

They left the restaurant and rode a walkway through the gaudy, busy Ginza. Yoshio stared wide-eyed at the colorful theaters, bars, nightclubs, casinos, and other entertainments. Even though the corporate regulations no longer barred him, his meager allowance balance did. "Where are we going?" he asked.

"To fulfill a father's obligation to see that his son's ship of love gets properly launched." He laughed heartily. "Or has it been already?"

Yoshio managed to answer through his embarrassment. "I passed Personal Relations with a ninety-six percentile grade."

"I don't mean class exercises. I mean the real thing."

Yoshio remembered painfully the evening Aki and he had tried some of what they had learned from the class pillow book. Inexperience plus the watching and listening slave collar had resulted in a miserable experience that he hadn't tried to repeat since. In his opinion love was highly overrated. "Once . . . almost."

"I see. Well, relax and trust me."

They got off at the traditional-style entrance of the White Moon House. "This is the most expensive geisha house in P-Tokyo!" Yoshio whispered urgently. "I can't afford it!"

"Consider it another graduation present, son."

Yoshio returned to his room well after midnight, exhausted but filled with very pleasant memories. He looked forward to correcting the mistakes he had made with Aki.

As he climbed into bed he felt wonderful. Moments later, without any explanation or warning, the mood burst like a balloon in vacuum. He was horrified to find himself crying for the first time in many years. He was alone in the

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darkness and everything was gone and it all came spilling out in spasms of sobbing that shook his whole body. He felt wretched and ashamed, but he couldn't stop.

"You have a visitor," the door announced. It took him several seconds to pull himself together enough to ask, "Who . . . is it?"

"It's me, Yoshio." His group mother's voice came from the speaker. "May I come in?"

His need for her was stronger than his shame. "Yes . . . please!"

She entered, sat on the edge of the bed, and gathered him into her arms. His crying and trembling subsided.

"What's wrong?" she asked softly.

"I don't know, Mom! I'm . . . scared and I . . . I . . . don't know—!"

She stroked his forehead. "My poor little spacer. I think I can explain, but I can't make it hurt less. You're homesick."

"But . . . I *am* home. How can I . . . be homesick?"

"Imagination is a great gift, but it lets you rush ahead to meet pain. You will put these changes behind you and be as secure in your new life as you were here. I promise you."

"I know, Mom. But—"

"Remember this, my little spacer. I will always be your mother. You can come to me any time you have a problem, or just to chat."

"Yes, Mom."

"Now, tell me all about your evening. Did you and your role-father have a good time?"

They talked for awhile, until he stopped crying and felt empty but less upset. Then she kissed him and left.

As he fell asleep he wondered how Mom always knew when he needed her. He decided that was just how Moms were.

Second Line

When Yoshio stepped out of the Port pubtrans station, he walked very carefully. This close to the city's axis of spin his centrifugal "weight" was less than one-third of normal. He took a walkway to the Belt Mining Company's cubic, cleared security at the administration center, and rode a service cart out onto the field.

Ship berths were lined up in a row, and most of them were occupied: cargo drones, crew shuttles, scoutships, even a module from a refinery complex. Trucks were bringing supplies to the ships and taking away unloaded products. Support personnel and robomechs were swarming over some of them. The air reeked of various chemicals, and the din was painful to one used to the civilized quiet of the residential levels. Over each berth a ship-sized portal in the curved ceiling led to the accel/decel shaft.

Yoshio loved every noisy, smelly, confusing cubic centimeter of it.

Berth eleven was near the far end of the row. *Polaris* was a Hana class scoutship built by the Hitachi Corporation, one hundred and eight meters long, powered by a 120 MW fusion generator and driven by four mercury vapor ion engines. Sitting horizontally in the berth's metal latticework, it looked like a stick with a ball on each end. The front ball held the cabin, life-support, and working equipment. The rear one was the generator. The stick contained the en-

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gine accelerator shafts and the wrap-around fuel tanks. The hull was shiny high-permeability alloy.

The airlock hatch opened as he got out of the cart and removed his space kit. The cart started back. "Permission to come aboard?" he asked. The sub-vocalizer was a necessity here; even a shout couldn't have been heard.

"Permission granted," Taro's voice replied.

He climbed into the airlock, then into the cabin. It was a half-globe four meters in diameter, designed for freefall and therefore odd-looking to a g-oriented perspective. But he was used to it. He was also used to the cramped quarters. Spacers lived and worked together in this cubic for up to three months at a time; claustrophobes and people who couldn't get along with other people didn't become asteroid scouts.

Taro was standing near the hatch waiting for him. "Welcome aboard, son. Stow your kit and we'll get right to the pre-boost checklist. We're scheduled for a slot in fifty-five minutes."

"Yes, father." Yoshio remembered a great deal about Nobuo's duties from his two trips. He put his kit in Nobuo's empty bin, then turned to his role-father.

Taro was looking at him with a grim expression. "I have something to say to you before we begin. As your father I can forgive many mistakes. As your captain aboard a ship in space I can't forgive any. Understand?"

"Yes, fa . . . yes, captain."

"Call me father, but keep thinking captain. Let's get to it."

Taro sat in his chair at the control station, and Yoshio took the other one. Under Taro's supervision Yoshio used the inboard comp to test all the ship-board systems. Nervous at first, he soon became engrossed in the myriad details of clearing a spaceship for boost. Finally he looked up from the databoard. "All systems are nominal, father."

Taro grunted. "Good job. Slow, but speed will come with experience. Don't *ever* try to work faster than you can do a job properly." He activated the com. "BMC S27, *Polaris*, calling SpaceCom."

"SpaceCom here," a pleasant female voice said from the speaker.

"Request clearance to boost at ten oh nine per filed flight plan."

"You are cleared to boost. Transponder set to ABR mode, channel six. Good hunting."

Taro started the boost program. "T minus nine minutes," he said to Yoshio. "Acceleration stations. You don't want to bounce through this one."

"Yes, father."

The acceleration couches that doubled as their beds were built into the rear bulkhead. They spreadeagled themselves against the hydraulic pads, and fastened the safety webs over them. From there they were still able to watch the control station holotank's view of the boost.

The latticework rose from the berth, lifting *Polaris* into the hole in the ceiling. They stared at the dull gray wall while the portal closed below them, air was pumped out, and another portal opened above them. The upward motion resumed, and soon the wall gave way to a shaft in which the ship fitted like a pubtrans train in its tunnel. Kilometers beyond the nose camera the shaft's

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mouth opened on spinning space. All weight was gone.

"Thirty second acceleration warning," the comp's pseudovoice reported. Yoshio began a muscle relaxing exercise, and his concentration was so good that the boost actually surprised him. Ten g's of magnetically induced acceleration hurtled *Polaris* into space and him into unconsciousness.

When he woke up he saw Taro unstrapping himself, and awkwardly did the same. The ship was in freefall. "How long was I out?" he asked.

"About ten minutes. Your bed telemetry says you came through intact." Taro floated over to the control station and checked the comp databoard. "A very good shot. SpaceCom put us right on our line—no attitude burns until we reach Belt Three." Proxima Tokyo orbited proto-planet four every one hundred and seven minutes. The combination of the orbit and the city's gyroscopic motion could aim the accel/decel shaft at any point in the celestial sphere.

Yoshio peered over Taro's shoulder to see where they were going. "Sector B3-267?"

"Getting curious? Okay, now I can tell you what's what. The bio shipment from Earth due last week has been lost."

Yoshio's first reaction was to wonder how such a stupid mistake could have happened. The second, and stronger, was to worry about what would happen if it wasn't found.

The *Uchu-giin* civilization had spread out through the systems of Sol and the twenty-three nearest stars, but its survival depended on an uninterrupted supply of two commodities from Earth. Trace elements not available locally were needed to ensure proper nutrition. And fertilized embryos from *nisei* women had to be imported, because *Uchu-giin* women were infertile. Centuries of research hadn't uncovered the cause, although a link was suspected between the lack of lunar tides and the menstrual cycle.

Taro read the worry in his face. "Relax. There's a one hundred percent safety factor in the delivery schedule. We would have to lose several more before there would be any real danger. But if the shipment isn't found, growth plans will be set back system-wide."

"How could SpaceCom lose an inbound interstellar cargo drone?"

"Supposedly it can't happen, only it did. The drone had three radar beacons. The second backup was sending when the drone entered our system—something had already knocked out the first two. During the drone's final deceleration something else, maybe a meteoroid, cut it off as well."

Yoshio thought about the drone diving to a fiery end in the corona of Proxima Centauri, or following a hyperbolic course back into interstellar space. But again Taro was ahead of him. "Based on the position data from before the beacon died, SpaceCom figures it's in a parking orbit around Prox waiting for someone to come get it. Which is what we're doing. The possible orbits take in a pretty big cubic, but our part of the search grid is here."

He put B3-267 in the holotank. Much of it was shaded by an orange cube. "We need a minimum-time search pattern. The special gear can pick out the drone from the rocks, but its range is

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only twelve thousand kilometers. Think you can plot it?"

"Yes, father." It sounded like a fairly straightforward math problem. "Shall I?"

"By all means. Remember to leave us enough fuel to get home, and try not to bump us into anything."

Yoshio worked on it for almost an hour before he was confident of his solution, then he showed it to Taro. His role-father checked it thoroughly and nodded. "We'll use it. Now let's go over the duty schedule."

Long ago it had been discovered that boredom was a spacer's deadly enemy, attacking his mind and spirit. The solution was a busy routine that left no long periods of unoccupied time.

Taro put the schedule on the databoard, and Yoshio looked it over. The ship's operation and maintenance took precedence. Then sleeping, eating, and personal duties. As for the remaining time . . .

"Study?" he asked plaintively. "But I've finished all my classes."

Taro shook his head. "You've learned how to think and walk around without tripping, but if you want to be an asteroid scout your real education begins now. And never ends—I'm still learning. Astronomy. Astrogation. Spaceship engineering. Geology. Spectrography. Comp engineering. The procedures manual. Asteroid mining history. And a lot more. I brought plenty of cubes for both of us.

Yoshio slipped easily into the routine, and found that the sense of structure helped to keep his mind focused. He worked well with his role-father; they interfaced in the small cabin without significant friction. He even enjoyed the study sessions. Not only were the subjects important to his career, but they were interesting. Taro supplemented the cubes with stories from his decades of experience.

One of the cubes dealt with the formation of the Alpha Centauri system. It was unique, and it troubled astronomers greatly. Every other known system was a Sol type (a star surrounded by planets and lesser objects), or a multiple star type (no planets, just comets, meteoroids, gas, and dust), or a VB 8 type (a star and a proto-star, a huge gas giant planet that just missed becoming a star).

Alpha Centauri A and B were two stars orbiting each other. A few comet mining and research operations had been established there, but not much else. Proxima Centauri was the center of the system's *Uchu-jiin* civilization for the same reason it confused astronomers. The cool red class M star was 17.4×10^{6} km away from the double stars, yet was still held in their gravitational grip. Maybe that grip had prevented the creation of planets, or maybe the three stars had used up too much of the coalescing matter during the formation of the system.

Whatever the reason, Proxima Centauri was surrounded by an amazing collection of debris. Seven asteroid belts were spaced according to Bode's Law. But where Bode would have put belts number four and five there were instead the proto-planets, two and three of them respectively. Proxima Centauri's contributions to astronomy occupied equidistant points in their orbits; they were dirty iceballs of water, gases, rock, and

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minerals roughly the size of Earth's moon.

For the *Uchu-giin* who lived by scavenging space, Proxima Centauri was a treasure trove.

"Father, how do you think the protoplanets happened?" Yoshio asked when he finished reading.

"Too early to tell."

"I don't understand."

"We've only really studied the few dozen systems we've colonized or probed. We don't have enough data yet to answer all the questions. But we will."

For seventeen hours the engines added a gentle one-half g acceleration to the ship's boost velocity, then the trip was made in freefall until the flipflop and deceleration. Seventy-six hours and fifty minutes after the boost, *Polaris* reached Belt Three at sector B3-267. Taro set up Yoshio's search pattern in the comp. They were strapped into their control station seats.

"Ready?" Taro asked.

Yoshio's eyes were on the radar and spectroscope databoards. "Yes, father."

"Good. The first sweep begins in three minutes. It'll take five and a half hours. During this time we must concentrate on our jobs every second. Can you handle it?"

"Yes, father. But the comp is running the sweep. Why am I doing this?"

"For the same reason I'm keeping an eye on the piloting—backup. Comps are smart, but they can be inflexible and dogmatic. If you spot *anything* out of the ordinary, log it and we'll check the recordings after the sweep. Here we go."

Inside the belt looked just like outside it at first, but soon an asteroid appeared on Yoshio's databoards. Laser spectroanalysis indicated it was mostly rock. The new radar, using short "hard-edged" wavelengths for better imaging, showed a rough block nothing like a drone's streamlined (for moving through interstellar gas and dust at .5 c) needle shape. The comp was silent. "Not this one," Yoshio reported crisply.

He repeated the procedure over and over as *Polaris* passed asteroids. The results were uniformly negative. His initial excitement soon wore away. The repetitive, unproductive activity became pure drudgery. The breaks between probes were brief or non-existent. His eyes burned, his neck ached, and he was getting hungry; the chair provided water but not food. The sad comfort of self-pity began to grow in him.

He noticed his concentration wavering, and became angry at his weakness. He pushed all thoughts but his duty out of his mind. He made himself part of the search, and nothing more.

Finally it was over. They were through their assigned cubic, and swinging around for the second of five sweeps that would completely cover it. "Good work, son," Taro said as he yawned broadly. "Lock your boards down."

"Yes, father. But . . . I didn't do anything. I didn't find the drone."

"You found a place where it isn't, which is part of the job. Process of elimination. Now you heat dinner while I report to SpaceCom."

"Yes, father."

Taro aimed the com laser at Proxima Tokyo, and learned that none of the other scouts in the hunt had yet found the drone. They ate, performed some

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routine duties, then strapped into the acceleration couches for six hours of sleep before the start of the next sweep.

"Wake up, son." Taro's laughing voice snapped him awake instantly.

"I'm up," he said as he unstrapped. Taro was working at the control station. "Are you setting up the next sweep?"

"No. I canceled it."

"Why?"

"Good news from SpaceCom. One of the other scouts found the drone over in B3-271. It's undamaged except for some micrometeoroid holes in the control module that caused the beacon failures. Prox has already boosted a recovery mission. You and I are out the finder's bonus, but I'm glad that somebody found it."

"Me too," Yoshio said sincerely. Mom was right about imagination and pain; he had been thinking a lot about how fragile the *Uchu-giin* ecosystem was. "So you're calculating our return course?"

"No. We stopped working for Prox when the drone was found. Now we're Belt Mining Company asteroid scouts."

"I don't understand."

"I'm going over the recordings from the first sweep. The gear Prox lent us is much more sophisticated than our own. Under the terms of the charter contract we can't use it after the drone is found, but we've already probed over thirty substantial rocks. I'm looking for signs of commercial values."

The notion made Yoshio vaguely uncomfortable. "Is that ethical, father?"

Taro frowned at him. "The BMC lawyers say it's legal, and who am I to argue. As for ethics, they don't exist in business. I could tell you tales that would curdle your blood."

Yoshio had never liked the so-called law of the economic jungle, but he didn't want to disagree with his role-father. "Have you found anything?" he asked.

"I just started. You get caught up on your studies—by then I'll know one way or the other."

Yoshio hit the cubes. Hours later he finished a difficult lesson on eccentric orbits and said, "I'm done. Did you find anything?"

Taro turned his chair to face Yoshio. He was smiling. "Maybe. Maybe you'll walk away from your first scout trip with half of a fat commission in your account. Check those spectral lines and radar density readings, and tell me what you think."

Yoshio stared at them until his head ached. "I'm sorry, father, but they don't make any sense to me."

"Don't worry, I didn't recognize them either without the comp's help. Isolating out the low-grade iron ore, I think we've found a big node of chromium, manganese, titanium, and maybe some vanadium."

Visions of wealth danced in Yoshio's head. He knew what the spacecraft and power industries were paying for those rare metals. His commission might even be enough to buy a second share of Proxima Centauri Corporation stock to go with the one he had received at birth. That would increase his dividends to more than the life-support fees. But money was a minor consideration beside the honor gained by owning two shares, especially at his age.

"Strap into your chair, son," Taro

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said. "I've plotted a one-g course to the rock—we don't want anyone beating us to it. Two minutes to burn."

Yoshio strapped in. The high acceleration inside a belt made him nervous, but he didn't say anything.

"It's a calculated risk," Taro admitted, either guessing Yoshio's worry or answering his own. "The avoidance program will maneuver us around anything big enough to show on radar. As for the smaller stuff, it won't have enough relative velocity to do us much harm."

They reached maximum velocity without any trouble, and the flipflop went smoothly. As *Polaris* decelerated Yoshio began to breathe easier.

Taro had been right about the velocity of the small asteroids moving with the belt. But meteoroids also came from elsewhere in the system at kilometers per second.

A savage noise ripped through Yoshio, somewhat like an explosion and somewhat like tearing metal, painfully loud. It was followed by a sharp hissing. The engines shut down.

Yoshio turned and stared in mute horror at a ragged five-centimeter hole in the hull through which he could *see stars!*

For an *Uchu-giin* there was no disaster more feared than a blowout. It cut to their most basic cultural insecurity, the hostility of the environment that was their home. Yoshio knew he had to patch it at once, but he couldn't move.

He cried out in his mind for Taro to save him. The air pressure was dropping fast, pulling at his skin and hurting his eyes, sucking the breath from his lungs. The hole held his gaze with a hypnotic fascination, but out of the corner of his eye he looked at Taro.

His role-father hung limply in his chair's straps, motionless, eyes shut. The back of his shipsuit was torn and bloody.

"Father!" Yoshio screamed, jerking around to face him.

Taro's eyes blinked, then closed again. "Help . . . son—" he groaned.

Yoshio tore at his strap releases. He noticed for the first time that he was bleeding from a long cut above his left knee, but he ignored it. Instinctively he started toward Taro. Then he stopped. He struggled to control his panic, and partly succeeded. To help Taro he had to think, not react.

Patching drill. It was one of the first things Taro and Nobuo had taught him. Turning away from his role-father was the hardest thing he had ever done, but he dove toward the spacesuit bin.

Rule One was to suit up before anything else. Otherwise you might not live long enough to do anything else. He yanked out both suits.

And didn't know what to do next.

Rule One told him to put his own suit on first. If he took the time to get Taro into his, he would be risking not only both their lives but the ship which was more important. But Taro was ashen-faced, and Yoshio couldn't see any breathing.

"Father, what should I do!"

In the distant reaches of his mind he heard an answer. Abruptly his fear and uncertainty were gone, replaced by hopeless determination.

Letting Taro's suit float toward the hole, he began pulling his suit on. He moved deliberately, not skipping a seal

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or safety check, as his role-father had taught him. His vision was blurring and he was having trouble concentrating as he connected the helmet umbilical. Then a cool oxy-helium breeze cleared away the cobwebs.

He hurried to Taro and repeated the process. Taro wasn't breathing, and bloody froth was coming out of his mouth and nose. Yoshio worked steadily, a robotech creation existing only to complete its task.

When air was flowing in Taro's helmet, Yoshio checked the suit's med telemetry readouts.

There were no vital signs.

He pulled the medkit from under the chair, and slapped it onto the connection plate on Taro's suit. Yoshio stared at the databoard as probes entered Taro's body and the medkit went to work. Adrenalin. Cardioshock. Blood oxygenation.

The cabin was in total vacuum. All he could hear was his own ragged breathing.

He checked the time. Amazingly only six minutes had passed since the blowout. Sticky brown balls of patching compound were drifting everywhere; the automatic system wasn't designed to cope with a hole this size.

No vital signs. The medkit kept working.

Yoshio removed the patchkit from its bin. He clumsily flattened the surface around the hole with the diamond sander, then glued a suitable patch over the hole. He had the comp start repressurizing the cabin. It would report any loss of pressure indicating a bad patch job or a second hole.

No vital signs. The medkit kept working.

Yoshio floated and watched the databoard.

Fourteen minutes after the blowout the message BRAIN DEATH CONFIRMED. RESUSCITATION PROCEDURES TERMINATED appeared. The medkit shut down.

Misery crashed down on him, sweeping aside his *Uchu-giin* training. He curled into a fetal ball and cried.

Third Line

Yoshio fought the return of awareness, the sensations that came from being. He wanted to go away into the darkness forever. The space beyond the hull was no colder and emptier than his thoughts. Tears floated around him, and splashed against the cabin surfaces.

Seppuku was for honorable ascension to the higher plane, not just to escape the pain of living. If he came to Taro now, his role-father would turn away from him. And rightly so. He was the cumulation of much effort and expense. He had a responsibility to repay his debt, to serve with productive work, before his life would be his own to discard.

But how could he go on living? He couldn't move, he could barely think.

One of Seijun's lessons came back to him. Emotional pain must be understood before it could be eased. What exactly was he feeling? Not grief; he knew that was valueless egotism. Guilt? No. He had done what he was supposed to do, and he could forgive himself since Taro undoubtedly would. Shock? That was passing. What was left?

Loss. His life stretched endlessly be-

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fore him, and Taro was gone from it forever. Was there a cure for loss?

Just this. Understand that Taro continued to exist in him, and live in a way which would honor his role-father.

He made himself stop crying, and wiped his eyes. Time enough for tears later. There was work to do.

He strapped into his seat, not looking at Taro's body, and called up emergency procedures from the comp. After reviewing them he checked *Polaris*'s course. It was still moving through the belt dangerously fast; that would have to be corrected first.

He ran through the systems checklist and determined there was no damage. The comp had shut down the engines as a safety measure. He calculated a new deceleration to compensate for the interruption, and began the burn. The cabin atmosphere indicator was green again, so he removed and restowed his spacesuit.

Now what? He ached to call SpaceCom and ask for help. But he was no longer a child who could cry for his group mother when things went wrong. He was a spacer, an employee of the Belt Mining Company and second—no, now acting captain of the scoutship *Polaris*. The ship was serviceable and so was he. What would Taro do?

He activated the com. "BMC S27 to SpaceCom. Special VSR, copy to BMC Operations."

"SpaceCom here. Go ahead, BMC S27."

"Acting captain Esaki reporting. Ship holed by micrometeoroid at twenty sixteen today. Captain Todoroki is dead. Ship repaired and operational."

A pause, then, "Do you require assistance?"

"Negative. *Polaris* is engaged in a scouting operation. We will return to homeport upon completion per filed flight plan."

"Please keep us informed of your status. Good hunting."

He cleared an equipment bin and gently placed Taro's body in it. Then he treated his bloody but shallow leg wound, cleaned up the cabin, and planned a new duty schedule under which he would do the work of two.

The treasure asteroid was a surrealistic pyramid roughly two kilometers across the base. He was relieved to find no radar beacons in it. He anchored *Polaris* to it, planted a Belt Mining Company beacon, then ate and tried to sleep before going to work.

He had helped Taro and Nobuo scout rocks, but doing it himself was a much different matter. Fortunately the comp contained detailed procedures. He used the ship's (non-loaned) radar and spectroscope to do a surface analysis. Then he cut a pattern of cores with the laser drill and ran a spectroanalysis of the outgassing.

The EVA had been his favorite part of the other trips, but he got no pleasure from it this time. He moved awkwardly around the rock in his spacesuit, placing HE charges and sonar probes, then carried out the deep scan. He was particularly careful; Taro had told him horror stories about accidents with the charges.

He returned to the cabin and spent several hours studying the data, assembling his report on the rock. It was everything Taro had guessed. But the ore values were just part of the data,

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without any visceral meaning to him. He sent the report to the Belt Mining Company Operations department in company code. Eventually one of the mammoth refinery complexes would come to digest the rock. Then he updated his return flight plan with SpaceCom, and received a decel slot.

The return was a lonely reflection of the flight out. He followed the duty schedule with desperate precision, and spent his free time remembering Taro. He saw his role-father with new eyes, as a man rather than a model, and in the end felt closer to him than ever before.

He gathered his remembrances into a verse in the haiku form. Suitably inscribed on rice paper, he would place it in Taro's shrine.

Happy was the spacer
who walked his long road,
living until he died.

Not quite Bassho, but he was pleased with it.

When *Polaris* neared Proxima Tokyo, it was decelerating at one-half g. Yoshio transferred flight control to SpaceCom and tested the link three times.

"BMC S27 to SpaceCom," he said into the com. "Requesting clearance for decel per filed flight plan."

There was a pause, then the female voice said, "SpaceCom here. We recommend that you abort. You have sufficient reaction mass to decel to zero relative. We can send a tug to bring you in."

Entering the shaft mouth for final deceleration was a very precise maneuver. The anti-meteoroid particle beam system was set to blast any inbound ship that strayed from its course, to prevent collision damage to the city. SpaceCom knew he was inexperienced. It was trying to protect the ship and him, possibly at the Belt Mining Company's instruction. It could only suggest: there were few situations in which anyone could override the flight decisions of a captain in space.

But if he aborted it would go in his record. And Taro would be ashamed of him. "BMC S27 to SpaceCom. Negative to abort. Requesting clearance for decel per filed flight plan."

"You are cleared. Welcome home."

He strapped himself into his acceleration couch, and emptied his mind of doubt. If anything went wrong now, it would be over too quickly to notice. He watched the holotank.

The grip of the accel/decel shaft was like a club slamming consciousness out of him.

He woke up to a holotank view of the Belt Mining Company field. *Polaris* was just settling into its berth. He unstrapped, removed the ship's log from the comp, put on his subvocalizer again, and entered the airlock with his space kit.

There were people waiting to meet him as he climbed down the ladder. A group of men in Belt Mining Company dress uniforms stood beside two service carts. With them was his group mother.

Seeing her was a shock, but he resisted the lure of old habit patterns. He walked over to the ranking company official, a VP according to his insignia, and bowed. "I am Yoshio Esaki, sir, acting captain of BMC S27. Captain Taro Todoroki died in honorable service to the company. May I deliver the trip

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log to you and be relieved of my temporary duty?" He held out the log cube.

The VP took the log. "I am Yakita Katayama, representing the Belt Mining Company. You are relieved of duty. Please contact my office at your convenience to settle the paperwork."

"Yes, sir."

"We have reviewed your reports, and we are fully satisfied with your performance while in our employ." The VP paused. "Captain Todoroki is aboard?"

"Yes, sir. In storage bin C."

The VP gestured, and two of the lesser officials went aboard *Polaris* with a stretcher. They returned carrying Taro's body.

As the stretcher passed them on its way to one of the service carts the VP, Yoshio and the others bowed. A sudden silence claimed the vast field as hundreds of spacers and support personnel also bowed. The silence lasted until the company delegation had driven Taro's body off the field.

Yoshio was left alone with his group mother. She stepped forward and took him in her arms. He felt nothing.

"Don't hold back your tears," she whispered. "I know how much it must hurt."

But she couldn't help him this way any more. He gently pulled free. "I can't."

She seemed to shrink in front of his eyes, and her face was twisted by sadness. "I understand. But I can cry for both of us. It's time to go home."

He took her hand, and they quietly walked off the field.

His room seemed small and unreal, a stage set from a play which had closed. Still it did offer some lingering comfort. He unpacked, bathed, and went to sleep.

His sleep was troubled by strange dreams, as it had been since Taro's death.

In the morning he received a note and a package from the Belt Mining Company. The note informed him that Taro's funeral would be at one o'clock this afternoon. The package contained a Belt Mining Company dress uniform in his size.

The door said, "You have two visitors."

He told it to open. Masumi and Aki were standing there, looking a bit nervous. "Welcome back," Masumi said.

"Are you okay?" Aki asked.

He remembered how to be Yoshio the classmate. "Sure. Thanks for coming, both of you. It's good to see you."

"We're going to breakfast," Masumi said. "You coming?"

He wasn't hungry, but it was expected. "Okay. I'm looking forward to eating real food again."

Breakfast with the group was a reminder of how good his life had been. He joined in the conversation, catching up on news and gossip. His group mother hid her concern well. The topic of his trip was avoided by all.

At one o'clock he was seated in the front pew of the temple hall that the Belt Mining Company owned jointly with several other firms. The floor, walls, and ceiling were Shimada Chemical's new golden glowcrystal; to Yoshio it was like being inside a jewel, surrounded by its fire. The altar was gold-veined neomarble carved with pastoral scenes of Japan-that-was. Taro's body lay on top of it, wrapped in a dark brown

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yukata. In front of the altar a Shinto priest was chanting a mantra.

As Taro's only kin, Yoshio had a place of honor next to the Belt Mining Company's owner and his two *ronin* samurai. Behind them sat Nobuo and about sixty of Taro's friends and co-workers.

The mantra ended. The company owner walked to the altar, flanked by the samurai, and touched Taro's brow. He whispered something to Taro, then he said to the guests, "Taro Todoroki served the Belt Mining Company well for thirty-three years. He died as he lived, with great honor. He is now among our ancestors who nurtured life in the emptiness of space. He will be remembered."

Yoshio bowed his head, and felt nothing. This wasn't *Uchu-giin* training to avoid grief. This was an emptiness of the spirit that left him less alive than the husk on the altar.

The company owner returned to his seat. Yoshio walked to the altar and kissed Taro's forehead. "Goodbye, father," he whispered. "I love you."

He sat down, and stared straight ahead unseeing while the others bid Taro farewell.

The priest recited the Prayer for the Dead. Then he resumed chanting the mantra.

The neomarble slab supporting Taro's body slowly descended into the altar. When it rose again the body was gone, on its way to the processing plant where it would be broken into needed organic materials.

The funeral was over. Yoshio took his place in the procession which marched into the sun and blossoming cherry trees of the Street of the Gods. He sat on a bench on the temple lawn to rest; he was more tired than the effort of being on his best behavior could explain.

Suddenly he was in shadow. He looked up, and saw Nobuo glaring at him.

"You let him die!" Nobuo growled.

Yoshio felt the dream terror where real and surreal mix, where friend becomes foe and nothing is certain. "I don't understand," he said to himself rather than Nobuo.

"I saw the VSR's!" Nobuo's face was an angry power looming over him. "You saved yourself, but you didn't save him!"

"I followed the patching drill. What else could I have done?"

"You could have thought! You could have improvised, slapped something —anything—over the hole, then treated him! The drills aren't meant to be a substitute for personal responsibility!"

Without waiting for a response, Nobuo stalked away.

Yoshio had believed he was beyond pain, but he was wrong. He now discovered the true meaning of the word. He didn't doubt Nobuo's words; there had been a way to save his role-father, and in his panic he hadn't seen it. Taro, please forgive me! I didn't know!

For a long time he sat on the bench and suffered. Slowly he rebuilt his armor of unfeeling, this time thicker and stronger. He needed it. A lifetime of hard work lay ahead, to reduce his shame when he faced his role-father again.

The week of mourning for close kin was rarely observed among *Uchu-giin* for the obvious reason, but Yoshio

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chose to honor Taro and soothe his own spirit this way. He spent most of his waking hours in the dorm's shrine, chanting mantras and remembering. At the end of the week he did feel better able to face the future.

The meal conversations were almost exclusively about Recruiting Day. His classmates were showing signs of their intense anxiety; Masumi was overly cheerful and confident, while Aki was quieter than usual. He was almost grateful for the tranquility of uncaring when he saw how his friends were suffering.

He visited Katayama at the Belt Mining Company's administration center. He settled the paperwork ending his association with the company, and his pay and commission for the treasure rock were deposited into his account.

Then the VP handed him a small box. "Taro's assets have of course been returned to the Proxima Centauri Corporation, but these of his personal effects were willed to you."

"Thank you, sir." Yoshio bowed and left.

Outside he opened the box and found pictures of the two of them taken through the years. He looked at them for a long time. They would go in Taro's shrine, which he planned to establish in his home as soon as his employer assigned him one.

At the spectacular Proxima Centauri Corporation headquarters he bought a second share of stock. He took no pleasure in it, but it was the proper thing to do and Taro would approve.

Masumi and Aki kept him involved in the group's social activities, the final adolescent flurry before assuming career responsibilities. There was the traditional auction at which they sold their room decorations to younger students, keeping only what they would take to their company cubics. They sampled the Ginza's delights, attended parties, went wingflying in the low-g parks, and so on.

One night Aki talked to him about love and wanting to bed with him. He gently declined. He liked her too much to involve her in his shadow play.

Recruiting Day began at nine in the morning. Well before then Yoshio and his classmates were sitting or milling nervously in the group's common room. The group mother was checking the faxer that she had hooked up to the comp terminal.

"We're ready," she said. "Everyone please be seated and quiet. I'll pass out the offers. Please contain your enthusiasm until I'm done." She smiled. "I'm very proud of you all, and I know you're going to do well."

At nine sharp the comp said, "I have messages." There was a collective deep breath, then absolute silence. Companies had sent their job offers at the traditional time. They were stored in memory, and would be faxed one by one.

The first synthetic rice paper sheet slid out of the faxer. Everyone stared at it. Yoshio was curious about his classmates' karma more than his own.

The group mother handed the sheet to Mie Nishioka. Mie read it and radiated happiness. She visibly ached to share her good news, but managed to maintain her self-control.

Another sheet appeared and the ceremony went on. Almost everyone received more than one offer; Masumi had

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the most with five, and Aki had three. Already options were being weighed and decisions made. Silent joy passed from face to face.

Only Yoshio and the group mother noticed that his hands were empty.

When the last offer was handed out they were still empty. The common room erupted into excited conversations. Full of themselves and the special moment, none of his classmates noticed as Yoshio left the room.

But the group mother hurried after him. "Is there anything I can do to help you?" she asked softly.

As the initial shock and disbelief faded, Yoshio felt curiously relieved. "Thank you, Mom, but no. I'm going to my room."

She looked at him closely, and bowed her head. "I understand. Sometimes our karma is too unkind. Remember that I love you."

"I love you too, Mom. Goodbye."

As he walked to his room he fitted the puzzle pieces together. The companies to which he had applied would have seen the record of his trip, and reached the same conclusion as Nobuo. No one wanted an asteroid scout who stopped thinking in an emergency.

No one.

In his room he undressed and put on the formal kimono Taro had given him. I tried to be useful, father. But I have no place, no work to do. All I can do is relieve the city of the burden of my unproductive presence.

His dresser held the box containing the *seppuku* pill every *Uchu-giin* received when old enough to accept the responsibility. But he didn't reach for it. Instead he picked up an elegantly wrought sheathed knife. He sat cross-legged on the floor, drew the knife and set it in front of him. Then he bared his stomach.

He wasn't scared. He was finally at peace, freed from all obligations to go on living. No easy painless pill for a patricide. He knew how to perform *seppuku* properly, piercing the abdomen then cutting right to left.

He lifted the carbon steel blade and pressed its point against his skin below the ribs.

The door opened. It wasn't supposed to do that without his permission, but it did. Nor did it announce anyone.

A man stood just beyond the doorway. An ancient man, tall and gaunt, who held himself erect despite his years. His bald head glistened like gold, and his wrinkled face held a thoughtful expression. His *kamishimo* and *hakama* were of white silk. "May I come in, Yoshio Esaki?" he asked in a gravelly voice.

Yoshio's incipient anger at the intrusion became startled confusion. He dropped the knife, rose and bowed as low as he could. "Of course, High Lord!"

He recognized High Lord Moriya Okitsu from lessons and from the media. The creator of the Proxima Centauri Corporation, the first *Uchu-giin* extrasolar venture, had guided it since its beginning. He looked a healthy seventy years old, yet over two centuries had passed since his birth. Because he spent many years in interstellar transit, his ka carried by a laser pulse to a body grown from his DNA code, he had aged slowly while generations of stockholder-citizens lived and died, worked and built.

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The High Lord entered. He looked at the knife and Yoshio's bared stomach. "Why do you want to destroy something others have worked hard to nurture, something of value?"

"But it's . . . I'm not!" Yoshio blurted out, then froze in horror at his conduct. "Forgive me, High Lord, please."

"Speak your mind."

He composed himself. "No one wanted to hire me."

The High Lord smiled, and his power was such that Yoshio immediately felt better. "Actually you are much in demand. Nine firms were prepared to offer you employment when I interceded. They withdrew their offers at my request, although the Belt Mining Company in particular was very reluctant to do so."

Yoshio's confusion was increasing radically. "I . . . I made a bad mistake on my scout trip, High Lord, and my . . . the captain died because of it. His regular second told me I could have saved him."

"I know what Nobuo Koroshi told you," the High Lord said. "Forgive him, he spoke from the pain of his loss. He was wrong. You did the right thing in a situation where it was the hardest choice."

"But if I had tried to plug the hole first, I might have saved him!"

"Or you might have succumbed to hypoxia, or your makeshift patch might have failed. In either case not only Taro Todoroki but your ship and you would have been lost. Spacer drills, like so many parts of our culture, are of necessity designed for the good of the whole. Taro Todoroki died, but *Polaris* and you returned."

Yoshio didn't know what to think. The High Lord was known to be one of the wisest *Uchu-giin*. . . .

"I have come here to offer you a career in the Proxima Centauri Corporation." The High Lord's expression sharpened.

This wasn't right. The High Lord of the Proxima Centauri Corporation didn't deliver job offers. "Excuse me, High Lord, but I don't understand. I . . . just want to be an asteroid scout."

"And so you shall be. But in time you will tire of such simple work and be ready for more demanding tasks. I know you quite well—indirectly, of course."

All Yoshio could manage to say was, "You know me?"

"The Proxima Centauri Corporation is more than a business," the High Lord said, and his voice became strong. "It is responsible for the lives and well-being of all of its stockholder-citizens. You have had a taste of how heavy such a responsibility can be. A special type of person is needed to bear it; intelligent, imaginative, strong enough to do what must be done yet not callused to human feelings. Such people are rare. We search constantly, and find all too few."

Yoshio couldn't believe it was he the High Lord was discussing. "I'm very honored, High Lord."

"But?" Again the High Lord smiled. "I hear the 'but' in your voice, and I know why it is there."

Could that be true? "Please, High Lord . . . can you tell me why I don't care about anything anymore?"

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The High Lord actually placed a hand on his shoulder. "Yes. We both know it is not for the obvious reasons—your spirit is strong enough to survive such blows. But they have directed your awareness to a deeper problem. You are suffering from a realization of the futility of existence. Your role-father died. You will die. Everyone and everything ends."

Yoshio trembled from the harmony between the High Lord's words and his inner emptiness. "Is there . . . an answer?"

"There are as many as there are people. Would you care to hear mine?"

"Please."

"I look on my life as a work of art sufficient unto itself. It may be ephemeral, but an artist's satisfaction is in the fulfillment of his creative vision."

The High Lord paused. "I know you so well because we are of a type. That is why I am confident you will find your own answer."

The emptiness was breaking up, returning to the unreality which had spawned it. Yoshio smiled. Not the boy, or the lost soul, but the man. He looked up into the centuries-old eyes. "Thank you, High Lord. I humbly accept employment with the Proxima Centauri Corporation."

"That is good. I bid you goodbye until we meet again."

Yoshio bowed low. When he rose, High Lord Okitsu was gone.

And Yoshio Esaki set out to walk his long road. ■

●Fresh discoveries and new inventions are no longer the result of fortunate accidents which we are expected to note with awe. They are all a part of the day's work, anticipated, deliberately intended and brought to pass on schedule. We should be amazed indeed if tomorrow and tomorrow and tomorrow failed to offer something new to challenge our capacity for readjustment.

Carl L. Becker
The Heavenly City of the Eighteenth-Century Philosophers

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Elizabeth Moon

SWEET DREAMS, SWEET NOTHINGS

Any product designed for people must take into account what they'll *really* do with it, not just what they *should* do with it.

Paula Hobart saw the ad on TV first. That famous overweight actress, the one who'd done ads for a dozen different diet foods, climbed into a canopied bed, pulled up the satin sheets and fur coverlet, and relaxed into her pillow. One plump hand reached out to the bedside table, fumbled for a pill, and slipped it between rounded lips. As the picture hazed, indicating sleep, gorgeous shots of pastry, custards, towering ice-cream sundaes hung over the sleeping woman's head. Her delicate pink tongue came out, licked her lips. She smiled, turned her head from side to side, sighed in obvious ecstasy. Then a shaft of sunlight came through the window, the dream-foods faded, and she woke up, smiling, and pushed away the syrup-laden pancakes her maid brought in to her on a dainty breakfast tray.

"I had Sweet Dreems," she said

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cheerfully, into the camera. "And now I don't need sweets." When she unwrapped her robe, she looked at least ten pounds lighter than when she did the More-Is-Less ads for pizza. In fact, she looked lighter than she had climbing into the bed the previous night.

Paula herself wasn't really stout. As she had explained to a series of unconvinced gym teachers and doctors, her family had always had large bones. Heavy bones, denser than normal. The skinfold thickness one doctor demonstrated she insisted was the thick skin that went with heavy bones, plus the muscular development of her arms.

"From shoveling in the food?" the doctor had asked, her own slim body hardly strong enough, Paula was sure, to stagger from office to carpark.

"Lifting my babies," Paula had replied, sullen. She didn't go back to that doctor. But it was getting harder and harder to find the kind of doctor she wanted, the kind who knew it was natural to get a little heavier with age, especially if you come from a family of big-boned women. She kept looking for someone who would quit the hassling and just give her the medicine she needed to keep going: the pills for blood sugar, and the pills for high blood pressure, and the pills for her backache and the pain in her feet. And most of all, the pills for appetite, because while she wasn't fat, and wasn't even really *stout*, there were times when any woman wanted to be . . . well . . . a few pounds less than she had been. Between Thanksgiving and New Year's Eve, say, when she always had trouble. Just like everyone else, of course, but still.

So the ad caught her eye. She'd tried the More-Is-Less diet foods for awhile, and they worked for awhile, so maybe this would work too. The fine print that scanned across the screen didn't interest her, but the 800 number did. She punched in the call right then, using the TV-phone attachment Kenny had bought for Christmas last year. And the very pleasant young woman on the phone seemed interested in her. She bothered to ask *which* sweets Paula liked best, and just how much weight she needed to "control." Paula liked that. She didn't really need to lose, exactly, it was more that she wanted to control it where it was. Or maybe 25 pounds lower, where she really fitted that paisley formal just perfectly.

The package came by private carrier: the truck had multicolored stripes on its side, and at first Paula thought it was a new ice-cream company in town, and hunted through her purse for some loose change. But she saw the driver get out with a package, and figured out what it must be. She was angry when the driver wouldn't take a check or card, insisted on cash. The woman on the phone had warned her, but still. She fumbled the spare fifty out of the lining of her purse and handed it over, frowning. But when the driver handed back the small change, and she had thumped the front door, she forgot about that anger.

She could take the pills all this week, while Ken and the boys were off camping, and surprise them when they came home. She left the pills on the kitchen counter and went back to the bedroom. In the closet, down at the far end, was the paisley dress. She shrugged out of her robe and pulled out the dress. She

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couldn't have gained *that* much. In the mirror, several inches of Paula showed on either side of the dress when she held it in front of herself. She saw the mirror-face twist, the mouth purse unhappily. Well . . . maybe the pills would work.

But before she started another diet . . . she hung the dress up and pulled on her robe again. She had saved a walnut-supreme coffee cake in the freezer, hiding it from Kenny and the boys under a pyramid of liver and stewing beef. Two hours later, comfortably full of coffee cake, she decided she didn't need more sweets that day. She'd wait until the pills had a chance.

The box had a large multi-folded sheet of directions and warnings. Paula ignored everything but the section labeled "Taking the first dose." On the first night, she was to take the two pills in the silver packet with a large glass of water (large was in heavy print) thirty minutes before bedtime. If any disturbing symptoms developed . . . she didn't go on: why scare yourself? They wouldn't advertise it on national TV if it wasn't safe.

The pills themselves were a lovely rose color, not the usual pink used on pills. Paula swallowed them down, careful to drain the glass of water. That was at ten; she watched the news, seeing the same ad she'd seen before. Now it made her feel good, like one of the insiders, almost glamorous. She didn't have to be told again and again about a new product; she was already using it. This time she noticed that the banana split shown in such vivid detail had caramel sauce on the strawberry ice cream end. She hated caramel sauce; she hoped her own sweet dreams would be *her* favorites.

Then she went to bed, and fell asleep just as usual. And woke the next morning, when the neighbor's car revved in the driveway, just as usual. She couldn't remember a thing. No memory of licking the whipped cream from a silver spoon, no memory of wedges of chocolate cake topped with fudge frosting and nuts. Nothing. She frowned at herself in the mirror. She wasn't any skinnier, either.

In the kitchen, she stared at the package of cinnamon rolls on the counter. They looked a little stale. She wasn't really hungry, but if she didn't eat them, they'd be wasted by the time Kenny and the boys came back. Paula tore open the package, and took a bite of the first roll. Definitely stale; they didn't taste nearly as sweet as they had. She ate that one, and two more before deciding that they were really too stale to eat. She dumped them into the trash slot, and put a cup of hot water in the microwave.

Paula thought of using sugar in her coffee, but since she was on a diet she opened a packet of Suprsweet, the newest low-cal sweetener. Her first sip tasted awful, hardly sweetened at all, so she tossed in another packet. The morning TV programs were showing spring fashions (in November! It made her sick!). This year all the models had braided hair, arranged in intricate loops and spirals. Of course they were all skinny. Paula knew they were also sick; she'd read about models and dancers having psychological diseases from trying to stay skinny: anorexia, and bulimia, and drug addiction, too.

When the ad for Sweet Dreems came on, she watched it closely. It said—or

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showed—that the actress dreamed about sweet foods, and then woke up and refused them. But she hadn't dreamed at all. She couldn't remember even one dream of sweet foods. And she'd eaten those cinnamon rolls, this morning, and she'd needed two packets of Suprsweet in her coffee. The pills weren't working.

She looked at the sheet of directions she'd left on the table. It did say, right under "Taking the First Dose" that she might not notice a change for a day or so. All right. That made sense. But surely she would remember dreaming about her favorite foods, wouldn't she?

That night she decided that the pills must be meant for someone who was really fat: a small-boned woman, who (at Paula's weight) would be much heavier than she should be. But for Paula, heavy-boned as she was, the pills weren't quite strong enough. She'd had that problem with medicine before. She had argued with one doctor after another about it, insisting that she should have more pills, or bigger pills, because she was "denser." So although the directions for "The First Week" told her to take one pill every night, she decided to take two. It hadn't really started to work, and she'd drop back when it did.

Unfortunately, the pills for the first week were packaged singly, in six gold-foil packets. They were even numbered. Paula opened one and two, and found herself confronted with a white pill and a blue pill. She scowled. The *first* two pills had been rose-colored. What did they mean, changing pills like this? She looked at the directions, and noticed a statement about "individually balanced for each day in the cycle." It didn't make sense to her, but it did imply that they had planned different pills, and it was all right.

Just then the ad came on again, and she watched the actress reach out for her pill. No foil packet there, Paula thought angrily. She just reaches out and puts it into her mouth. But she realized that it must be because of the camera. They wouldn't want her fumbling with the foil packet on the set.

Paula swallowed both pills quickly, and went to bed. She wasn't about to drink a large glass of water with each pill: one would do for both. She tried to stay awake until the first vision of dessert arrived, wondering which it would be, but she fell asleep still wondering.

When she woke in the morning, she remembered having some kind of dream, but not what it was. Something white and caramel colored, something about swimming, she thought. But no chocolate cake, no cherry pie, no boxes of expensive chocolates, no ice cream. And, in the mirror, she was still the same Paula, a little heavy around the hips. I was right, she thought. The pills aren't strong enough for me. She threw away her coffee that morning, because no amount of Suprsweet made it taste right. And as for sugar itself, it might as well have been sand. She didn't think that was the pills: the pills weren't working, because she couldn't remember dreaming about food.

That night she took three: labeled three, four, and five on their packets. Another white, another blue, and a green. And when that wasn't enough, the next night she took . . .

"It's perfectly safe," said the voice

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on the phone. "It can't be the Sweet Dreems."

"That's just fine," said Alan Lowery, on duty in the Williston Community Hospital Emergency Room. "But we've got this lady in a coma, and all they found in her house was a box of—"

"Well, it must be something else, maybe some drug—"

"*And* nothing showed on the drug screens," Alan went on with determination.

"You're sure?"

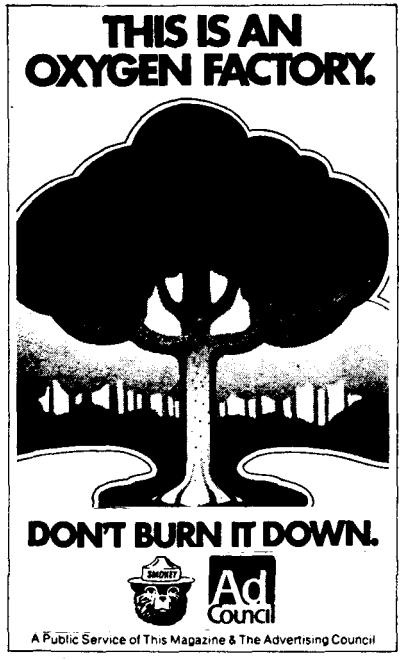
"Yes." Alan leaned on the wall and wondered why the oddballs always came in on his duty time. Kelly had told him nothing happened all weekend—not one thing worse than a stubbed toe—and so now he had this fat lady zonked out with a tube down her nose and no explanation, and her husband ranting and raving in the waiting room. And this kook at Biosym sounded just like the idiot at the tax office, the one who insisted that his house was actually two half-houses on the tax computer. He took advantage of the silence on the line, and went on. "So we want to know exactly what's in them, right now, so we can do the test and find out, and you'd better have a treatment plan—"

"It's not that simple."

"Who's talking simple? I've got this lady—"

"Yes, Doctor, I understand that, but it's not—" Another pause, and Alan heard a sigh, and a muffled voice in the background. Then clear again: "Look, I'm transferring your call to the labs, OK?"

"No! Don't hang—" But it was too late. The cover music was soft percussion, a style Alan hated, and then a series of clicks. He wasn't sure if the phone had just done serial transfers to someplace in Europe, or if the clicks were part of the music. Then another voice.



"Doctor . . . ?"

"Lowery," he said angrily. "Doctor Alan Lowery, Williston Community Hospital. And you are . . . ?"

"Dr. Hayes. In the research division. You have a problem?"

"Damn right, lady." Alan was past being polite. "We've got a woman OD'd on Sweet Dreems, and we need to know what's in those things, and how do we treat her?"

"She can't be," the voice started, but Alan made a noise that stopped her.

"Listen. We've got a woman in a coma—got that? Coma?—and she has a negative, completely negative drug

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screen. She's running a fever of 40 Celsius. We checked all the drugs in her house, and what we found was an open box of your product, that weight-loss thing."

"Empty?" asked the voice.

"Near enough. Lots of little foil packets, open, and three left at the bottom, in that separate little box. Guess she missed those. Well, we took those and tried—"

"You *what!*" Dr. Hayes now sounded wide awake and angry on her own.

"Well, we had to see what they were—" Alan began.

"You didn't destroy them!"

Alan began to wonder who was running the interview. "Listen lady—Dr. Hayes, I mean—I don't know what you think, but it's standard procedure, when someone comes in on suspicion of OD, that you test the suspected drug—"

"Oh, my God!" Alan heard a long wheezing sound, and stared at the receiver. Then Dr. Hayes started talking, fast and loud, and he found himself nodding in rhythm.

"So you see," she finished several minutes later, "without the erase cycle, and the resets, I think you're stuck."

"*I'm* stuck?" Alan snorted. "You're stuck. They were your pills."

"That idiot," Dr. Hayes said. She'd said it several times. "The materials we send are very, very carefully designed. Plenty of warning. Plenty of explanation. As long as they follow directions—"

"Which she didn't." Alan wondered how anyone could expect patients to follow directions. He'd given that up years before. He leaned the chart on the narrow shelf below the phone and pulled out his pen. "Now—you think the earliest she could have gotten those pills was Tuesday?"

"She called Sunday night. Monday for setup and production, and processing the order. If the shipment cleared Tuesday morning, it might have been delivered Tuesday afternoon."

"No way to tell?"

"Not really—not tonight. I can have someone call the delivery service in the morning, and see if they stored the delivery time and date on their computer. We don't."

"So she took—let me see—" Alan peered at his scribbled notes. "She took a three-week course of Sweet Dreems in five days—"

"All but the final pills," said Dr. Hayes.

"And the viruses superinfected?"

"I expect so. There's an insert for that, so that if the initial infection lasts longer than 24 hours, it won't delay uptake of the second."

"So what she'd got is a multi-virus infection, and a compulsion to dream of—"

"Whatever she told our order clerk. But keep in mind, Dr. Lowery, that the virus infection itself is harmless—"

"Sure it is." Alan let his disbelief show. "Just how do you know that a superinfection of all those viruses you used is really harmless? She's sick enough—"

But on her own ground, Dr. Hayes clearly knew her stuff. "We have proof," she said crisply. "All the relevant studies are on file. We'll dump them to your hospital's computer if you like."

"I'd like," Alan said. "ASAP." He punched the access code on the phone

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box, and watched the message screen. When the hospital computer acknowledged readiness for dump, he told Hayes to go ahead. Then, before she could take advantage of that pause, he went on.

"If it's not the viruses, then what is it? I still don't understand why a time-limited virus infection won't just go away in a few days. That's what happens with Fastbort. It goes in, attacks the sperm, attacks any ova in the tubes, and then drops out. Twenty-four hours, and poof! You claim this is time-limited, yet endless, and that doesn't make sense."

Dr. Hayes muttered something he couldn't quite hear, but suspected was unprofessional. "Do you read *Nature* regularly, Doctor? No? Well, it's explained best in an article we had out about six months ago: Schumacher, Ajiro, and Hayes. You're aware of gene insertions that allow viruses to carry messages to human cells: that's how Fastbort works." Alan grunted and she went on. "This is basically the same thing: modified vaccinia virus carrying messages. Only these messages are preferential to certain cell systems."

"I understand that," Alan broke in. "I understood what you said about having one make a hormone that speeds lipid utilization, and another carry protein-coded visual images, but—"

"But the thing is," she interrupted in turn, "only the virus carrier is time limited. The *effect* isn't. It's additive. The visualizations of the first virus are added to the second, and so on. Once the viruses have turned the brain on, imposed these visions in the dreaming state, that becomes a permanent part of the brain's imagery—until the last three pills reverse the process and clean it out. The same with cachectin. One of the virally inserted messages turns on its production, and restimulates it at weekly intervals. But your lady took three weeks' worth in less than one week; she's probably churning out enough cachectin for a terminal cancer patient—maybe more—"

"But she's still fat."

"She may have started really fat. If you weigh her now, and in twelve hours, and in another twelve, I think you'll find she's losing weight."

"We've got an IV going," Alan said. "And a naso-gastric tube. We can—"

"What kind of IV?" Again Dr. Hayes sounded flurried.

"Five percent glucose, of course. Just keeping it open now, but—"

"Glucose! For heaven's sake, cut it off!"

"Cut it off . . . why?"

"Because that's helping to keep her under, that's why. Listen, another one of the segments changes her response to blood glucose . . ."

"How many things have you got in there?" Alan was both alarmed and curious. "It sounds like you people have messed around with every damn organ system and enzyme system she's got."

"Obesity is not a simple problem," Hayes replied. "It's a multi-factorial disease, a highly complex combination of biochemical and psychological interactions, and you can't cure it by changing any one parameter alone."

"Well, that's just fine, but what are you going to do about my patient?"

"Stop that IV, first. Then—do you have a real-time blood glucose monitor?"

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"In a county hospital? Don't be silly."

"We'll send one, right away." He heard a faint clicking on the line, as if Dr. Hayes were keying into a desktop computer. "You'll need that to monitor her glucose levels, and a lipid monitor as well, to see how fast the cachectin is mobilizing her fat stores."

"What about her fever?"

"I don't know." Hayes's sigh sounded as tired as Alan felt. "We never ran into that, even in the overdose trials, but then we didn't think anyone would ever take the whole course in five days, and then not have the cancellation pills to clear it out with. Anyway, I'll be there in a few hours—"

"If we have a few hours." Alan looked at the chart a nurse had just tucked under his elbow. The patient looked "bad," the nursing notes said; she was cyanotic and her respirations were fast and shallow. Alan put his hand over the mouthpiece and spoke to the nurse. "Stop that glucose IV, and switch to plain Ringer's. Run it just barely fast enough to keep open. Have you got her on oxygen? Good—hit it up to 10 liters. It's not just a drug we're dealing with: it's a sort of virus thing." The nurse nodded and went back down the hall. Alan spoke into the phone again. "Look—Dr. Hayes, what do you think you can do if you come? You don't have privileges—"

"I can bring you the monitors you need, for one thing, and a solid link to our research computer. If this idiot has done what it looks like she's done, we'll need that kind of resource."

"But why can't we transport her to a hospital nearer you? It's not that I don't want the responsibility—" Though in fact that was precisely the problem. He could just imagine a prosecution lawyer hammering away at him, a mere emergency medicine doctor, for daring to manage a complicated and unknown problem. That was a message he'd heard many times: refer, refer, refer, before the disasters happen. "I just think she'd get better care from someone more experienced in this—"

"It hasn't happened before," Dr. Hayes said. "No, she's not stable, however she looks. I'll be there as soon as I can make it." And the phone line blanked. Alan frowned, shaking his head, and strode back down the hall to his patient.

She looked horrible. When they'd brought her in, she'd reminded him of lots of other fat women he'd treated over the years. There were the doughy soft ones, and the "round and firm and fully packed" ones; she was the latter type. Her skin had been taut, shiny over the cheekbones and knuckles, her body snugly rounding her skirt and pullover sweater. Even undressed, in a blue-and-white print hospital gown, her overweight body had been firm and strong. Now her skin seemed loose on that body, the flesh itself softer, as if it were melting inside. He had seen people lose weight before from fever, but never so fast. And a 40 degree fever wasn't that high. Her skin had an unhealthy lavender tone, not exactly cyanotic—her lips were still pink—but strange and forbidding. He was irresistibly reminded of fat literally melting, as if she had been carved of tallow and someone had

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left the carving near a fire. He shuddered.

"What is it, Doctor?" asked the ER nurse. "You said a virus—is she contagious?"

"No, she shouldn't be." Alan answered absently, as he checked the signs he knew to check. Blood gases were back from lab: not too bad, really, and if her oxygen was that good why was she lavender? Her last urine was even more concentrated; she was dehydrating. He thought of speeding up the Ringer's, but decided to wait until Hayes arrived . . . or until things looked worse. He put up the flat chest and abdomen films that had come back from radiology. Nothing much to see. . . . He went on talking. "Biosym says that the virus was just a carrier, as it is in Fastbort. What's happened is that it carried genes that coded for change in some of her enzyme systems. She took too many of those diet pills at once, so the changes overlapped."

"But she's not going to infect all of us?" The nurse still looked worried. Alan remembered that she had been out some weeks the previous year with an infection she'd caught from a patient.

"No." He shook his head again. "They used vaccinia virus, the same as everyone else, and it's that limited strain. Biosym's research chief says she probably doesn't have any live virus still in her." Nonetheless, he drew blood and spinal fluid for an analysis, just in case. The lab was already open, and if she did have live virus, he didn't want to wait until Dr. Hayes arrived. Then he stitched up a scalp wound from a fight in Ned's Place, and agreed with the ER nurse that the woman who'd appeared in labor really was. And then he sat and watched Paula Hobart breathe. At least she did breathe.

Hayes was there by dawn, a short trim woman with long red hair piled up on top of her head, lugging the heavy glucose monitor through the doors before Alan could offer to help.

"The lipid monitor's still out there," she said, nodding toward the entrance. "And I'm parked in your ambulance driveway. Here's the key." Alan found a porter to bring in the other monitor and park her car. She was already at the patient's side. The woman looked worse than ever.

"What's your IV now?" Dr. Hayes asked.

"Ringer's. I wanted an open line."

"Good. I got her profile from our computer—have you had time to read the files I sent?"

Alan felt his ears redden. "No, Doctor, I haven't: I have had an ER to run, and a very sick woman to care for—"

"All right; don't be defensive about it. I'll just explain." As she talked, Hayes hooked the glucose monitor into the wall sockets and began to attach its probe to the patient's hand. "I told you each course of Sweet Dreems is unique—that comes from the patient interview. Each one tells the order clerk what his or her favorite foods—especially sweets—are. We have a library of genetic messengers for all the common foods and flavors; it takes the system about four hours to load those into the virus. All the rest of the product is already loaded—"

"Isn't that terribly expensive?"

"Fairly, yes. But it works better when it's customized, and besides, we

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don't have that many customers yet. Later on, we hope to be able to use Kerrison's new technique for scanning existing memories and tying into them, so that we can send out a product with the whole library attached, and the patient's own brain will select its favorites." She turned on the glucose monitor. Its dials and display came awake, quivering needles and crisp digitals. The patient's blood glucose was only slightly elevated.

Dr. Hayes turned her attention to the lipid monitor, and began to hook it up as well. Alan had to admit she was deft and knowledgeable. "Her favorite foods," Dr. Hayes went on, "were all sweets and fats: she listed cakes, pies, ice cream, and whipped cream. We know which flavors she preferred. She said she wanted to lose 25 pounds. Now with some people, if they want to lose only five or ten pounds over the course of treatment, the changes in eating habits induced by the dreams and the change in sugar metabolism are enough. But those who want to lose more need the extra metabolic effect of cachectin. She'd have had that in the pill she took the second night, and again seven and fourteen days after that. We haven't messed with the normal breakdown mechanisms, because we didn't want to take that chance."

"I'm glad you stopped somewhere," said Alan. "Listen—her kidney function is way down, and I'd like to rehydrate. Is that okay, or will it foul up your readings?"

"No—not now that I'm hooked up." Dr. Hayes had plugged both monitors into a notebook-sized computer with a flip-up screen, and now seemed intent on whatever it showed. Alan moved around the bed to see, giving a quick glance at the monitors themselves. Glucose slightly above normal, lipids extremely high. Hayes's computer screen showed a series of curves he couldn't interpret, though she seemed to find them clear enough. He told the nurse to increase the IV flow rate. Dr. Hayes looked back over her shoulder at him.

"It's going to depend on just how much fat she's got to lose," she said. "You'll want to do a cachectin level, but I can already tell you it's high. She's freeing up her lipids, moving them out into the blood, and I think her fever is from a metabolic override: the combination of changes in sugar metabolism and the cachectin production. Right now there's no way we can change it—"

"Can't you give her the standard end-stage pill?"

"No. That isn't how it works. It doesn't turn off cachectin production—remember that that will normally decay over a week's time; that's why we induce it twice."

"But in cancer patients—"

"The message that turns it on is constantly being produced by the tumor cells themselves. No, we don't know how to turn it off. We only know that it will turn off by itself in the normal person. We could reintroduce her old sugar metabolism, but I'd be afraid to—I don't know how that would work with the cachectin in there."

"So we wait."

"And hope she's got enough fat to burn." Dr. Hayes sighed. "She looks like she should have, but there's no way to tell. I still can't believe she took all of them . . ."

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A couple of hours later, when the situation hadn't changed, and Alan's relief had arrived, Alan took Dr. Hayes down to the hospital cafeteria for breakfast.

"Such as it is," he said, yawning, apologizing for the leathery scrambled eggs and tired pastries.

"That's all right." Hayes, he noticed, ignored the Danish and sweet rolls, and chose a hard-boiled egg and a packet of bran cereal. Alan shuddered. Whatever it might do to him later, he couldn't function in the morning without something hot. He took a plate the server had already filled for him, and ignored Dr. Hayes' sidelong glance at the sausage and pancakes. She gave him another look when he picked up three packets of margerine and two of syrup. Alan found himself explaining, and annoyed with both her and himself.

"These things aren't edible without flavoring," he began. Her raised eyebrows made him sympathetic, for the first time, to his fat patient. He stuffed a hunk of sausage in his mouth, enjoying it.

"You don't have to explain," Dr. Hayes began. "You aren't fat, and if you enjoy those foods—"

"I was up all night and need something," he began again. He could feel his ears burning, and the back of his neck prickled. Why did he have to explain to her? He didn't. He changed his tack abruptly. "I still don't understand why a coma. You say that normally she should wake up after a night's sleep, having dreamed peacefully of her favorite foods—"

"Yes," agreed Dr. Hayes, setting down her spoon. "She wouldn't remember the dreams, of course, but—"

"She wouldn't? But I thought that was the whole point."

"Oh no. We found that if the subjects remembered those dreams, as vivid as the implants make them, that they'd overeat for the first hour or so after wakening. So we tagged a wiper onto the end: they dream, and the psychological effect is the same as sleep therapy, but they don't remember them when they wake up. As for the coma, I suspect it's simply an overload of the implanted dream sequences. The pleasure is so great, layered like that, that she just isn't waking up. I don't think it's metabolic."

"I think you just explained why she overdosed," said Alan.

"What? What did I say?"

He was childishly pleased to find that she didn't understand. So much for research: she might know the biochemical structure of the memory of the taste of syrup, but she didn't know why patients did anything.

"Think about your ad, the one on TV. You show someone dreaming of food, right?" She nodded. "And they wake up, and what do they say?"

Hayes shrugged. "I don't know . . . I don't watch the ads."

Alan grinned at her. "They say 'I had Sweet Dreems . . . I don't need sweets.' The clear implication is that they *remember* their dreams. You take someone like this—if they think they're supposed to remember the dreams, and they don't, they're likely to decide the drug isn't working—"

"It's not a drug," Hayes said wearily. Then: "Take more—why?"

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"It's the way they think. They expect an effect, and if they don't get the effect, they try more of the drug. Any drug. The same way they eat to feel a certain level of fullness, rather than eating a certain amount of food. I will bet you any amount of money, up to a year's salary, that this lady thought those pills weren't strong enough. She doubled, then tripled the dose, trying to get to the point where she remembered her dreams."

"But it says in the package insert . . . I'm sure it does . . . that they won't remember—"

"If she read the package insert I'm a transplant surgeon. That kind *don't* read, even if they can read. Is it a bet?"

"Yes, but not for a year's salary. How about dinner—not in this cafeteria?" Her eyes twinkled; she didn't look as if she'd mind losing.

"You got it." Alan ate the rest of his cooling pancakes as fast as he could. Then he leaned back. "The only thing is, now what do we do with her? How can we interrupt that luscious dream she's in?"

"I don't know. But if you're right, we'd better be sure she remembers dreaming, or she'll try it again."

"Can you turn off the wiper?"

"Maybe." Hayes frowned, staring blankly at her empty cereal bowl. "I hate to add anything to the mess going on in there though."

"Maybe we'll be lucky and the overlapping infections have cancelled the wiper."

Hayes laughed, the first relaxed sound Alan had heard from her. "We could stand a little luck, couldn't we?"

Paula Hobart woke up one morning with visions of ice-cream pie and triple-dip sundaes and a tower of chocolate fudge competing for space in her mind. At last, she thought. Just what I ordered. She stretched luxuriously. Something didn't feel quite right. When she opened her eyes and saw the red-eyed black boxes attached to her by wires and tubes, she gave a strangled gasp. Something was choking her. A nurse appeared swiftly, then two more. In moments the choking tube was out of her throat.

"Don't try to talk," said one nurse. "Your throat will be sore."

It was. Paula swallowed the strange-tasting liquid the nurse offered, and finally managed to croak, "Where am I?"

"You're fine," the nurse said with professional compassion. "You're in the hospital."

"Hospital!" This time her voice was louder. Paula looked around, then down at herself. Herself? The neat orange blanket barely made a hump in the bed. "It worked!" she said gleefully. "I'm just like the actress! And I don't even want syrup on my pancakes." ■

●The universe is full of magical things, patiently waiting for our wits to grow sharper.

Eden Phillpots

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The Alternate View

ANTI-GRAVITY II: NEGATIVE MASS

John G. Cramer

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Sometimes physics moves surprisingly fast, sometimes dismayingly slowly. In mid-December I wrote my AV column (*Analog*, July '86) on *antigravity*, a familiar SF concept. That column was based on a 1957 paper by Bondi on negative mass. Almost nothing had been published on gravitational repulsion in the almost 30 years since the appearance of Bondi's paper. The scientific "field" of antigravity research was essentially non-existent.

Then, as soon as my column was safely submitted, hot new results on antigravity appeared. The lead article in the January 6, 1986 issue of *Physical Review Letters* had the unassuming title: "A Reanalysis of the Eötvös Experiment" by E. Fischbach, et al. Two days later the *New York Times* ran an article with the headline: "Hints of Fifth Force in Universe Challenge Galileo's Findings" describing the importance of Fischbach's work. Peculiar experimental results from terrestrial gravity measurements and from the behavior of "strange" K-mesons (kaons) had been explained by a new theory proposing a "hypercharge" force, a new fifth force of nature which is gravitylike but which *repels* rather than attracting nearby masses. This new antigravity force is the subject of this AV column.

The first thread of this story goes back two centuries to Sir Isaac Newton. Newton discovered the famous gravitational "inverse square-law" relation, $F_{12} = Gm_1m_2/r^2$, which proved equally useful in predicting the orbit of the Moon and the force of gravity at the surface of the Earth. In Newton's equation G is a fundamental quantity called the universal gravitational constant. Among the physical constants of nature G stands out as being the most uncertain. Fundamental constants (the velocity of light, the electron charge) are usually known to a few parts per million, but G, with a value of 6.673×10^{-11} m^3/kg-s^2, is known to only about 1 part in 2000.

In a way, it is surprising that G is so poorly known. The orbits of planets in our solar system depend directly on G and are both observed and calculated to parts per billion. The problem is that to obtain G from these data we must have a completely independent knowledge of the masses involved in the gravitational attraction. Unfortunately we have no way, independent of orbital dynamics, of measuring the masses of the Moon, Sun, Jupiter, etc. Therefore, our imprecise knowledge of G must come from the very weak force of gravitational attraction observed in the laboratory between two masses, for example two large lead spheres placed close together.

But there *is* another way of measuring G. The oil industry has developed extremely precise devices for measuring g, the acceleration due to gravity, both on and beneath the Earth's surface. The dependence of the acceleration g on depth can be used to determine the gravity constant G. When the densities of

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the rock strata have been well mapped, this determination has an accuracy comparable to laboratory measurements of G. One would expect both methods to give the same value of the "constant." It is a big surprise, therefore, that the geological technique gives a value of 6.734×10^{-11} $m^3/kg \cdot s^2$ (instead of 6.673×10^{-11}). It would appear that this "universal constant" has significantly different values below the Earth's surface and in a surface laboratory.

The second thread of the story comes from particle physics. The species of particles called K-mesons or *kaons* are unusual among mesons in having a characteristic called *hypercharge*, a conserved property of certain particles. The neutral "matter" kaon or K°, theoretically a system composed of a "down" quark and an "anti-strange" quark, has a hypercharge of +1. Its antimatter twin, the $\overline{K^\circ}$, a strange quark and an anti-down quark, has a hypercharge of -1. Both K°s have the same electrical charge (Q = 0), the same spin (s = 0), and the same mass (about half that of a proton). From all external clues these two theoretical particles are indistinguishable except in their hypercharge, which is not directly observable.

In this situation where two states of matter cannot be distinguished externally, quantum mechanics tells us that a very interesting thing happens. The two indistinguishable states are "mixed" to make two new states of matter which *are* distinguishable. The "probability amplitude" (the quantity which is squared to get probability) of the $\overline{K^\circ}$ is subtracted from the amplitude for the K° to make the combination $(K^\circ - \overline{K^\circ})$, the amplitude of a distinctly different particle, the K_s which decays in about 10^{-10} seconds (and so called the "K- short"). Similarly the amplitude combination $(K^\circ + \overline{K^\circ})$ forms the particle K_L which decays 581 times more slowly (and is called the "K- long"). The K_L particle has been found to be *very* peculiar in its decay into other particles, showing a favoritism for *one direction of time* over another and for *matter* over antimatter. These violations of symmetry principles of nature (time-reversal and charge invariance) are not understood in any fundamental way.

But more recently another peculiarity of the kaon system has been discovered which is even more of a puzzle. Detailed studies of the K_L and K_S mesons have been made at a number of accelerator laboratories under a variety of experimental circumstances. When these experiments are reduced to the few basic "constants" of the kaon system, for example the K_L-K_S mass difference and the K_S half-life, these "constants" are found to depend on the velocity of the kaons with respect to the laboratory frame of reference. This is *not* a special relativity effect; those are already included in the data analysis. In fact, this velocity dependence cannot be readily accounted for by any of the four known forces or by any known physical effects.

Professor Ephriam Fischbach and his colleagues, in the paper mentioned above, have sought to explain both of these curious results, the variation of G and the velocity dependence of the kaon system, with a single theory. They start with the fact that kaons, neutrons, and protons all have *hypercharge*. Perhaps, the paper speculates, there is a new and very weak force associated with hyper-

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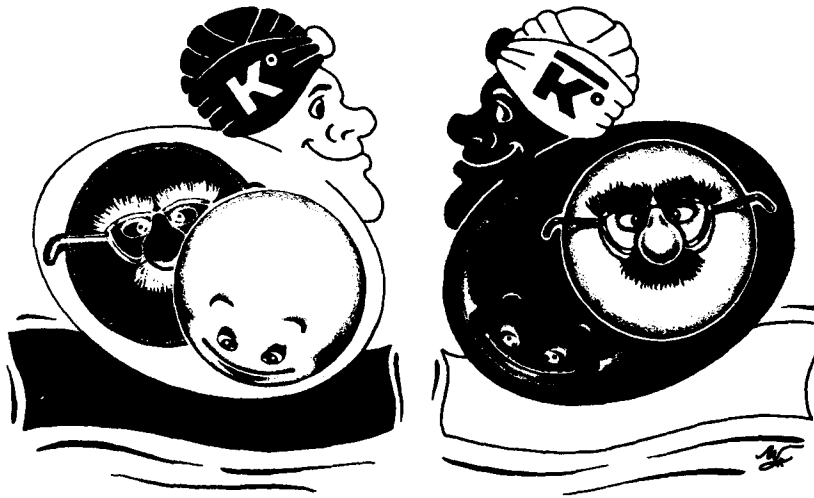

The K° kaon and its antimatter counterpart, the $\overline{K^0}$, unite to form the peculiar K_L particle which demonstrates the intriguing property of hypercharge during its brief lifespan.

charge which is responsible for the anomalies in both the gravitational and the kaon measurements. Starting from this point, they calculate the properties which such a "fifth force" must have to be consistent with these observations. They conclude that the new force would be very much like gravity, but with four important differences: (1) it depends on hypercharge rather than mass; (2) it is a *repulsive* force, in that objects with the same hypercharge are repelled from each other; (3) it has a strength only 0.7% that of gravity; and (3) it is a "short range" force which cuts off exponentially at distances on the order of 200 meters.

This last point requires some explanation. Two of the four known forces of nature, gravity and electromagnetism, are "long range" forces which fall off as $1/r^2$ with the distance from a massive or charged object but otherwise extend to infinity. The other two known forces, the weak and strong interactions, are "short range" and cut off to zero at distances on the order of the size of a nucleus. These differences in range are attributed to the masses of the "mediating particles" which produce the forces. Electromagnetism is mediated by the photon and gravity by the graviton, both particles with zero rest-mass which give their corresponding forces infinite range. The strong interaction is mediated by the gluon and the weak interaction by the Z and W particles, all of which have masses on the order of that of the proton and give their corresponding forces very short ranges. According to the "fifth force" hypothesis, the range of the force which would account for the G measurements and the kaon anomalies would have to be about 200 meters. This corresponds to a very light mediating particle (the "hyper-

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photon'') with a mass about 10^{-14} that of the electron.

This hypothesis can explain the G difference. Gravitating objects within a few hundred meters of each other, for example, the lead spheres in a laboratory measurement of G, feel a 0.7% repulsion from the hypercharge force which reduces the net attraction and leads to a slightly low measured value for G. The geological measurements of g, however, record the gravitational attraction of masses which are typically much more distant than a few hundred meters and give a value of G unmodified by hypercharge repulsion.

The hypothesis can also explain the kaon velocity dependence. The K° and $\overline{K^\circ}$, with opposite hypercharges are mixed in slightly different proportions of different velocities because the extra hypercharge force from the nearby neutrons and protons of nuclei in the laboratory acts oppositely on them. Thus their invariant properties become variables. The ''true'' properties of the kaons, according to the hypercharge theory, would be obtained if measurements were made in empty space with no hypercharge field from nearby matter to modify the $K^\circ + \overline{K^\circ}$ mixing.

Like any theory, this one needs testing. And one ''test'' has already been done and seems to agree with the predictions of the theory. This test was not a new experiment but a re-analysis of the Eötvös Experiment, the famous experimental comparison of inertial and gravitational mass performed by a Hungarian count in the early decades of this century and published only after his death in 1922. Fischbach and his collaborators realized that Eötvös *should* have seen some evidence for the hypercharge force. The reason is that the hypercharge of a nucleus depends strictly on the number of neutrons and protons in the nucleus, while the *mass* of a nucleus depends also on the binding energy of the system. Thus an iron nucleus with large binding energy has a larger hypercharge-to-mass ratio than does a hydrogen nucleus. To put it another way, a kilogram sphere of water contains fewer neutrons and protons and has a smaller hypercharge than a kilogram sphere of iron. Therefore the sphere of water should fall slightly faster in vacuum than the iron sphere because there would be a smaller hypercharge force acting on the water than on the iron. The Eötvös experiment should have shown the effects of these small modifications of the force of gravity. And Fischbach's re-examination of the Eötvös data reveals that indeed the predicted effect does seem to be present in the old data.

This new theory has had its first experimental confirmation. Much more work in testing for the hypercharge force needs to be done, of course, before it can be considered as established. This is a ''hot'' topic and many experimental groups, including one in my own laboratory, are swinging into action to do the testing.

But in the nature of this column, let's *assume* for the moment that the hypercharge force is real and consider its science fiction implications. First, by damn, we have antigravity! But no dancing in the streets just yet, please! For use in the ''normal'' antigravity way in science fiction, the hypercharge force does have a few problems: (1) it's too weak,

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and (2) it only works over a few hundred meters of distance. So we need some hypercharge "amplifier," some way for getting more hypercharge without getting more mass. That *might* be possible if there were massless particles (maybe hyper-photons or neutrinos), that have hypercharge without having a proton-size mass, but none such are known. Or perhaps there are "hyper-magnetic" effects when a hypercharged object is moved at a goodly velocity.

Anyhow, suppose we can overcome this obstacle and produce vehicles using hyper-repulsion. How might they work? Well, first of all the range is a problem. At 600 meters above the ground the range effect will cut down the hyper-repulsion to only 5% of what it is at the surface. So the vehicle would be most effective at distances of 50 meters or less above the surface. It might resemble the "floaters" and "grav sleds" which are common SF techno-props, but it would not be directly useful in space travel or propulsion.

It's worth considering also that in the process of repelling the ground, the hyper-force on our hypothetical floater would also tend to repel the *passengers*. This unpleasant side effect might be avoided by placing the repulsion sources for minimum effect on the passengers, perhaps at many points which lie on the same spherical surface. But passenger-repulsion might also be turned into an advantage by using it to reduce or nullify the forces of acceleration. With a suitable hyperfield system high-performance spacecraft or aircraft might, by balancing inertial forces with hyper-repulsion, be able to accelerate at many g's without squashing pilot and passengers. Free-fall space habitats might produce simulated gravity with hyperfield units mounted in the ceilings, with hyper-repulsion pushing the occupants to the floor.

Anyhow, stay tuned to this column for further developments on the hypercharge force. The definitive tests of the theory will be well in progress by the time you read this column. ■

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● There's nothing new under the sun, but there are lots of old things we don't know.

Ambrose Bierce

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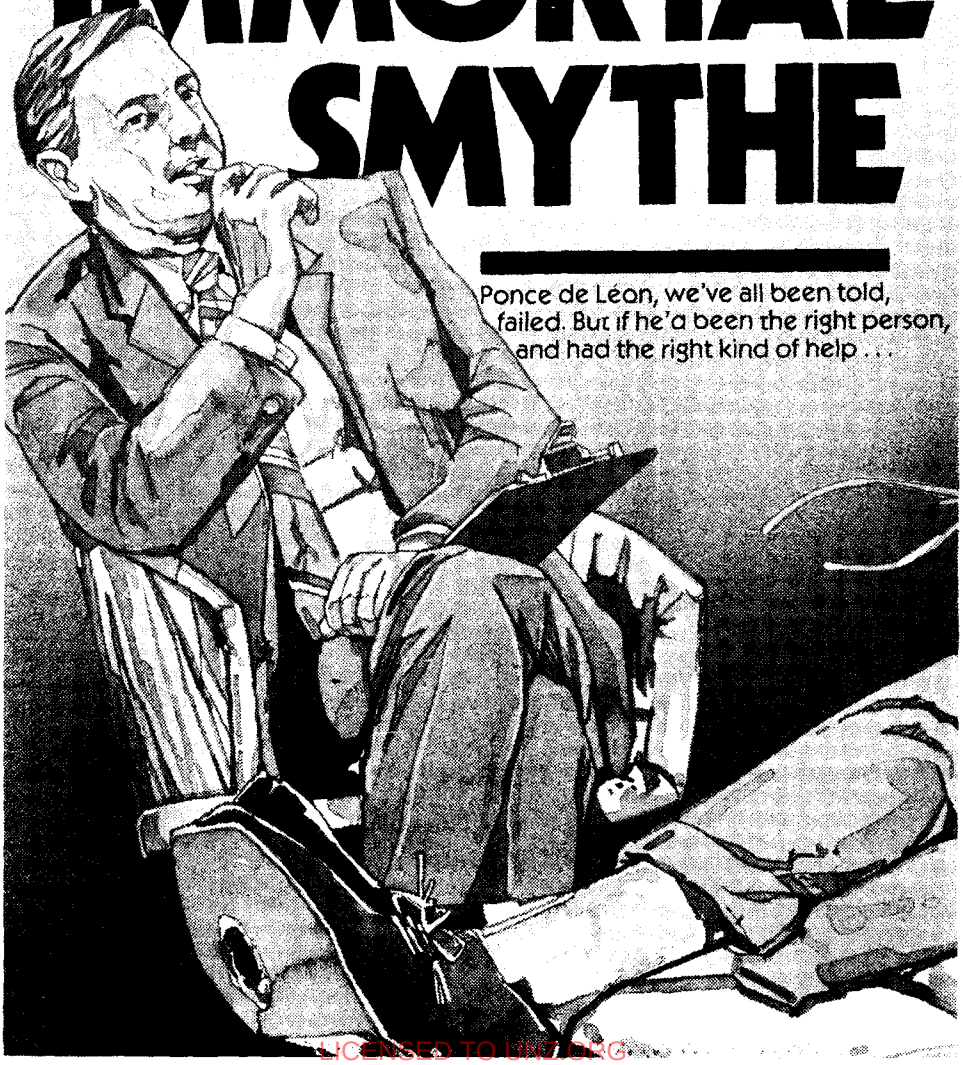
THE IMMORTAL SMYTHE

Robert C. Murray



Ponce de Léon, we've all been told, failed. But if he'd been the right person, and had the right kind of help . . .

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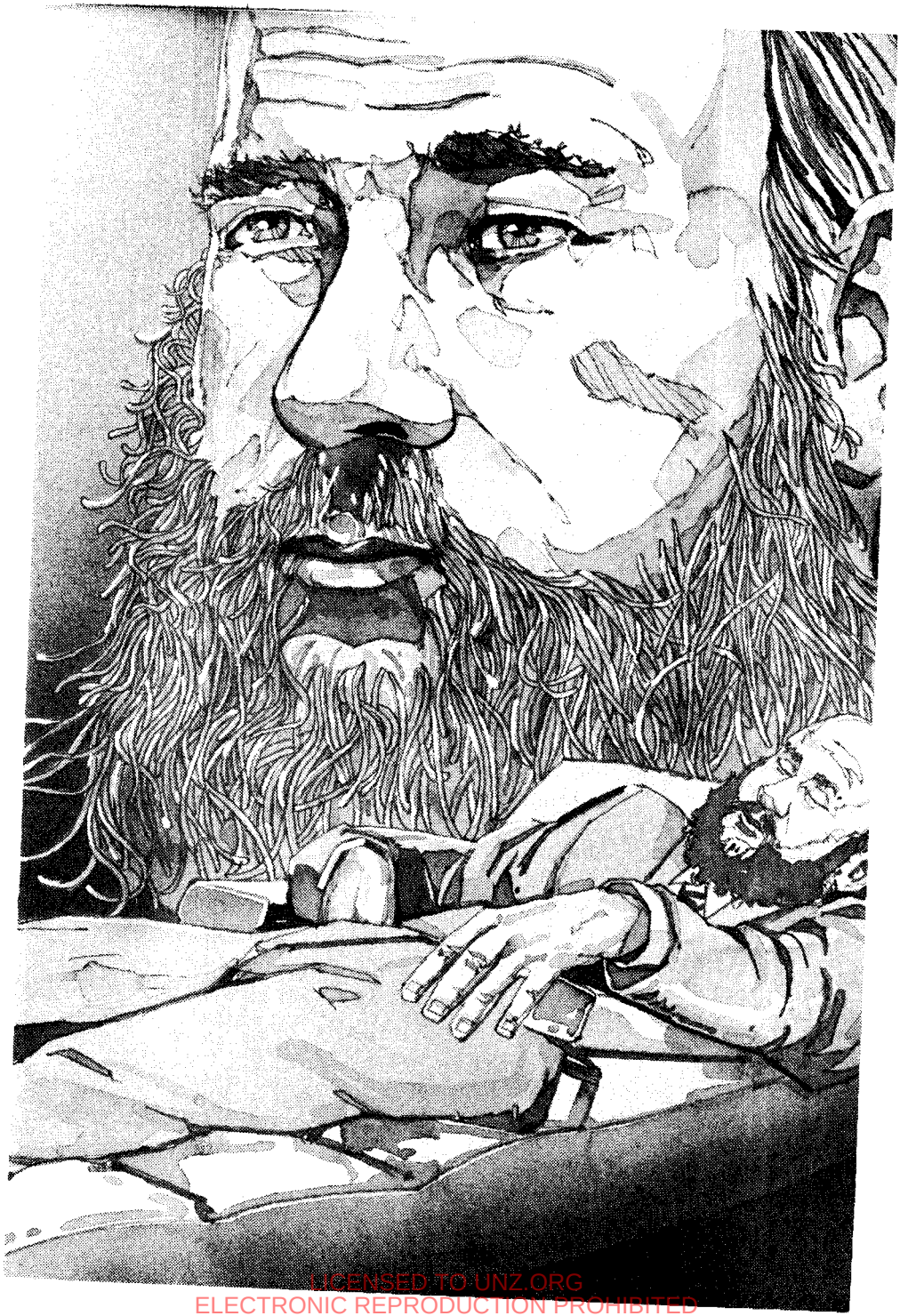

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"I mean, well for Christ's sake, Doctor, it's the third time I've tried this route!" Dr. Samuel Smythe sank back into the soft petrofabric sofa in the psychiatrist's office. His orderly physicist's brain was reeling under the ignominy of seeing Dr. Finelow as it was—the skeptical look on the physician's face did nothing to assuage the trauma.

"You really mean that on three separate occasions you've attempted suicide, Dr. Smythe?"

"No! Not attempted—succeeded! I've killed myself three times, but I keep coming back to life, damn it!"

"Now Dr. Smythe. Surely you don't believe you have been resurrected on three occasions? This may be 2301, but medical science, while considered somewhat above the quackery stage, cannot perform the ultimate Lazarus technique and restore the dead to the living. You have simply failed in all of your attempts to non-exist."

"No, no, no!" Dr. Smythe's long, red-brown beard quivered in indignation. "I have succeeded beyond any normal man's wildest dreams in doing myself in. The first time I non-existed, I backpacked to the top of Mt. McKinley and jumped. Face it, Doctor, when you jump off a mountain 20,300 feet high, by all rights you should be nothing more than a truncated sausage. But three days later, I was back walking down Lexington Avenue in good old New York, New York."

"You obviously landed on a sloping snowfield and slid the majority of the distance." Dr. Finelow took a prolonged pull on his pipe and wished he were out on the golf course.

"That's a possibility, though I really doubt it. I know the cliff I jumped from was a sheer two-thousand-foot drop."

"And the second attempt?"

"Not attempt. Actuality. I flew my plane—I am a licensed pilot—to fifteen thousand feet, put the plane on automatic pilot, drank four fast beakers of Navy grog—delicious, if you can find real passion fruit juice—and plunged headfirst into my old Ohio sod. Again, in three days, I was in good health and back in New York."

"While you were unconscious the plane glided into a relatively safe landing. Very lucky, I would say."

"Impossible, Doctor. I should have been dead. The plane was totally destroyed and scattered over hundreds of square yards of corn fields, but, upon recovering consciousness, I was unhurt."

"And the third attempt, Dr. Smythe?"

Smythe rubbed his bald head in a state of great agitation. "I am a musician, Dr. Finelow. For years I graced the world with the mellifluous notes of my golden horn. I decided there would be no greater death than that of dying by trumpetry."

"Trumpetry?" Dr. Finelow was truly perplexed. The baldheaded bearded patient in front of him was indeed an individual for whom the Cincinnati School of Psychiatric Healing had not prepared him. "What may I ask is trumpetry?"

"Very simple." Smythe eyed the ceiling with a delicious sense of remembered glories. "I ran a hose from my antique automobile exhaust pipe—no pollution control in those days—into the first valve of my trumpet. I then turned on the vehicle's ignition, sat down in

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the front seat, and played Beethoven's Symphony No. 6 in F Major."

"So?"

"Well, for God's sake, Doctor! As any cultured person knows, F on a trumpet is played by depressing the first valve. Each time I played that glorious note, or an E, an A, a D, or a B flat, I blew enough carbon monoxide into the car to annihilate the Philadelphia Philharmonic Orchestra."

"And yet you are still alive." Dr. Finelow's mind was no longer concerned with the dogleg on the fifteenth hole. There was something about Smythe that truly intrigued him. "Dr. Smythe, how old are you?"

"How old do you think?"

Dr. Finelow carefully considered the man sitting across from him. The beard and baldness added age, but there was . . . a resigned youthfulness in Symthe's eyes. "Oh, I'd say about thirty-eight."

"You're off, Doctor. Here." Smythe pulled a much-folded piece of paper from his wallet, spread it open, and handed it to the psychiatrist. "My birth certificate."

Dr. Finelow stared at the document for several minutes as if lost in thought. Then, he again read the pertinent information:

Name: Smythe, Samuel S.

Born: April 21, 1943

"Dr. Smythe, I assume there is some reason for showing me your great grandfather's birth certificate?"

"Mine, Doctor."

"Nonsense!"

"All you have to do is call in a forensic expert to compare the footprint on the back of that certificate with my own. It is mine, Dr. Finelow. I am three hundred and fifty-eight years old!" Smythe's beard began to glisten and his voice was trembling. "Why the hell do you think I've tried to non-exist myself three times?" Before the Mount McKinley fiasco, I should have died four times by accident and six times by disease. I've fought in the Lichenstein Revolt, the Great Tasmanian War of Succession and World Wars III, IV, and V. I've been shot in vital spots more often than I can remember, but I'm still alive. Damn it, man, each time something happens, in three days I've recovered. I'm immortal!"

All thoughts of his next appointment had fled Dr. Finelow's mind (a real tribute to Smythe—Finelow was notorious for giving his patients exactly forty minutes and no more, at $400 per session). He pressed a button to signal his receptionist that he didn't wish to be disturbed. This patient obviously thought himself immortal, believed it with every pore of his sweaty bald head. True, the process of aging had been slowed down greatly over the past hundred years. Anti-oxidants in the drinking water, freon-cooled undergarments which decreased the body temperature and slowed the metabolic rate, earth-orbiting sunscreens that filtered out all ultraviolet light—yes, it was common to live right to the so-called Hayflick limit of 150 years. But immortality was not considered feasible by even the most radical of the wild-brained molecular biologists.

"Dr. Smythe, do you remember when you first recognized this—this ability to be immortal?"

Smythe's bristly beard visibly relaxed

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as, for the first time, the physicist actually smiled. "The events surrounding the incident are naturally a bit dim, Doctor. I was only thirty-two."

"That would put it back in, uh, 1975?"

"Correct. Three hundred and twenty-six years ago!"

The psychiatrist pondered for a moment. "I would like to hypnotize you, Smythe. Through age regression techniques we should be able to get to the root of your delusion."

Finelow was immediately sorry he had used the word 'delusion.' The smile vanished from Smythe's face. His eyes hardened and the hairs of his beard seemed to positively writhe as the jaw muscles below them contracted. Yet Smythe's voice was calm and controlled as he answered.

"Delusion? I don't think so. I know what I am, Doctor, in more ways than you could possibly guess. What I don't know is how. There is something in my mind, some remembrance so close to the surface . . . perhaps age regression will tell us."

Finelow moved behind the couch where Symthe lay. "I want you to concentrate on that spot on the wall. Relax your body, relax your . . .

Fifteen minutes later, Dr. Finelow turned on his tape recorder and began.

"How old are you?"

"Three hundred and fifty-eight."

"No. I want your real age, not your fantasy age. When were you born?"

"April 21, 1943."

Finelow sighed. "So be it, Dr. Smythe. I want you to go back in time, back through all your suicides, your accidents, your illnesses. Back to the first event that triggered your belief in your own immortality. Go back to," he consulted his notes, "1975."

"1975. What a year this is—beautiful. I'm teaching physics and astronomy at Burgerdorf College—you know, one of those small Christian colleges for small-minded Christians. I am a bachelor, have time for writing, flying, camping—God, these are happy days." Smythe's voice stopped, and a beatific smile spread across his face.

"And?"

"*The trip. The trip is glorious this* year."

"What trip is that?"

"To West Virginia. Every year the Biology Department offers a course in biogeography. Two dozen students, a handful of colleagues—fourteen days of living with nature!"

"And you would go on this trip?"

"Oh yes. Even though I'm a physicist, I am also a fine herpetologist—a devotee of salamanders and newts."

"And in 1975 you again went on this trip?"

"Yes. A lovely valley, accessible by what the state euphemistically calls a road, but for all but the hardiest, really isolated. Once a week we go into the villages of Parsnips or Elkhorn for supplies. At night we take star walks or sit at a big campfire as I play madrigals on my recorder while old Dr. Frisbe accompanies me on his guitar."

"You sound very happy."

"Oh, I am. I wish it could go on forever. You see, this year I'm working on the taxonomy of the dusky salamander. Really a most complicated bit of work with the possibility of numerous subspecies and—"

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"The accident, Dr. Smythe. Is this where it happened?"

"Accident?"

"Yes, your first experience with immortality."

"My God, the water is so clear. Twolick Creek plunging down the Eastern slope of the valley. Rhododendron, moss, lush ferns—the plant life is amazing. And the aquatic creatures! Insect larvae of all types and—and look at the cnidaria! Hydra—filling the scattered pools, bodies extended from the substrate, with tentacles waving with the current. I've never seen so many; it's incredible! Even from the top of this boulder I can look into a pool where thousands of them are waving at me, beckoning, and I lean over to see better and I slip and—oh, Christ! The pain! The pain, so intense but brief, and I know my neck is broken and I am dead!"

"Dr. Smythe! Relax! Listen to my voice! The pain is over; you are not dead, you are fine. You are only stunned."

The obviously shaken Smythe continued. "Two days later, Dr. Frisbe and his combination ornithology class/ search party find me. 'He's dead,' says old Frisbe, giving his famous raven call as a eulogy. I'm covered, carried down to the cabin and driven to Elkhorn General Hospital. They put me in a body bag—the morgue is cold and soon the coroner comes with a knife to cut me and . . . oh, my, it's so funny!" Smythe's laughter filled the psychiatrist's office with gales of the distant past.

"What is happening, Smythe?"

"He yells to an assistant, 'His beard is moving,' and with that I sit up, step down from the table, and hum a few bars from a Polish mazurka as I dance around the room. Now I shake the poor man's hand and walk out of the hospital and Dr. Frisbe runs up to me yelling, 'A miracle! A miracle,' and back we go to camp." More laughter, loud but hollow, tinged with unexplicable terror.

"Dr. Smythe! We are traveling back to the present! It is not 1975; it is now 2301 and you are in my office. When I count to three you will awaken and feel perfectly relaxed. One . . . two . . . three!"

"The hydra! My God, the hydra!" Smythe's shiny bald head seemed to glow; his beard appeared to stand at rigid attention from his face. Without question, he was remembering.

One week later, one o'clock in the afternoon. The roles are reversed; Dr. Finelow is now agitated, upset, while Dr. Smythe is smiling and unperturbed.

"Yesterday I received the hospital tests I ordered, Dr. Smythe. I suppose you can guess the results?"

"Not 'guess,' Dr. Finelow. I told you before that I know what I am—I just didn't know how. Now, thanks to you, I do. Without reasonable explanation, a unique phenomenon can only lead to a denial of logic, and logic is necessary for my existence. That missing piece of the puzzle that drove me over the brink of suicide has been found. God, I feel like a new man—I feel alive for the first time in centuries!"

"But, it is so incredible! It's, well, unearthly!"

"No. It happened, and it happened in this world—in a small pool in a West Virginia stream where I had gone looking for dusky salamanders. I'm curious.

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When did you start thinking of this as a possibility?"

"Obviously, I was first struck by the powerful impression the pools of hydra made on you just before you slipped. Then, after you left the office, I noticed large quantities of cells—dandruff if you like—where your head and fingers were in contact with my sofa. The amount was inordinate. So, I did some reading." The psychiatrist smiled faintly. "I never thought I would gain an understanding of a client's problem by rereading a beginning zoology textbook."

"And you found—?"

The smile faded. "I found something I couldn't believe. So I had you go to the molecular genetics unit of the hospital for tests, and now," Finelow glanced at the report in his hand, "I suppose I have to accept the fact that you are what you say you are."

"The karyotype analysis?"

"Forty-six chromosomes, as expected. Forty-four of them normal. But each member of chromosome pair seventeen definitely has an extra piece attached—an interspecific homozygous translocation."

"How about the cytology report on the 'dandruff?' "

"Very abnormal. The cells are dead, of course. But they found not only skin cells—squamous epithelium—but also osteocytes, hepatocytes, fibrocytes—in short, representatives of every tissue in your body. There were also some cells that have yet to be identified."

"And finally," Smythe sighed softly, "what do the biochemical tests show?"

Finelow turned and walked to the window overlooking the medical complex far below. "Your body chemistry is normal, with two major exceptions. First, a rather bizarre collagen-like protein, possibly neurotoxic in nature though further tests need to be made. Secondly, your tissues show high levels of a unique endonuclease related to a large group of so-called restriction enzymes that molecular biologists have been using for several centuries in the recombinant DNA industry. This Rss, as we've named it, specifically cleaves some form of the hereditary molecule, DNA."

Smythe smiled again. "And you, I assume, have now guessed the specificity of Rss?"

Dr. Finelow turned from the window, sank into his chair, and, as if in a dream, continued. "All organisms live and die. There is no more basic tenet of biology. But certain cnidaria, most notably sea anemones which are closely related to hydra, defy this rule. As cells age, they *move to the extremities*—to the oral end with its many tentacles, and the pedal disk at its base. I would guess, Dr. Smythe, that when you remove your socks, there is as much evidence of cellular sloughing as there is from the top of your head."

Smythe's beard began to glisten, but the good psychiatrist was too absorbed in his thoughts to notice.

"New cells, of course, replace those that have sloughed off and died," said the psychiatrist. "The powers of regeneration in sea anemones and hydra are phenomenal. Of course, tissue complexity and diversity is so much greater in a human—the fact that you have this same capability is . . . is—"

Finelow's voice became an unnoticed

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whisper as Smythe's beard began to writhe about his face.

"And, Dr. Finelow, can you now reconstruct what happened?"

As if unaware of his client, the psychiatrist's voice increased in rate and volume as his analytic mind fit the final pieces of the immortality puzzle together. "You leaned over a pool filled with hydra. Their tentacles, armed with batteries of stinging cells unique to their phylum, were extended in search of prey. Somehow you slipped, fell among them, and crushed them by the hundreds. Their stinging cells whipped around you, covering your exposed skin with tiny openings—openings through which the biochemical contents of millions of broken hydroid cells could now enter. The Rss enzyme, some god-or-devil-given mutant that had no function within your body until this moment, cleaved the hydra's DNA at specific sites. The resulting sticky ends of their chromosomes attached to your seventeenth chromosomes, and a hydra-human transformation occurred. Your neck was broken, but you lived, and within three days the genes controlling regeneration, now a part of you, had done their work and you stepped from the coroner's table. Other gene loci dictated the migration of old cells to your extremities for removal. You then became, in spite of incredible environmental trauma, indestructable!"

Smythe's beard now stood at rigid attention from his face. "I can't tell you how much you have helped me, Dr. Finelow. I'm literally eternally grateful! You have put everything together so beautifully. I'm afraid, however, that were you to give the report of your findings to the hospital, they would quickly discover both the identity of the unknown cell type in my dandruff and the specific paralytic protein in my cells."

From between the bristling hairs surrounding his mouth, long, gleaming tentacles waved forth and encircled Dr. Finelow's neck. "You see, sir, a number of other hydroid genes were also attached to my seventeenth chromosomes." Huge welts appeared on Finelow's neck—he tried to speak but the effect of a paralytic chemical had already begun to manifest itself. He could only hear Smythe's voice, growing ever fainter. "The cells, of course, are cnidoblasts—the stinging cells found on the tentacles, and the protein is hypnotoxin, the cytochrome C inhibitor produced by these same cells. I'm really very sorry, Dr. Finelow, but I think now I rather enjoy my immortality. Why, I may even marry—three hundred and fifty-eight isn't too old! Just think how I could improve the human race!"

Dr. Finelow's receptionist looked quizically at the man with the bald head and long red-brown beard as he left the doctor's office. It wasn't often people whistled happily when leaving a psychiatric session. The tune was really catchy, but of course she had never heard the delightful theme from a movie over three hundred years old—a movie forgotten by all but the immortal Smythe—a movie called *The Sting*. ■

● If the mind were exercised as much as the mouth, we would be a race of geniuses.

Kelvin Throop III

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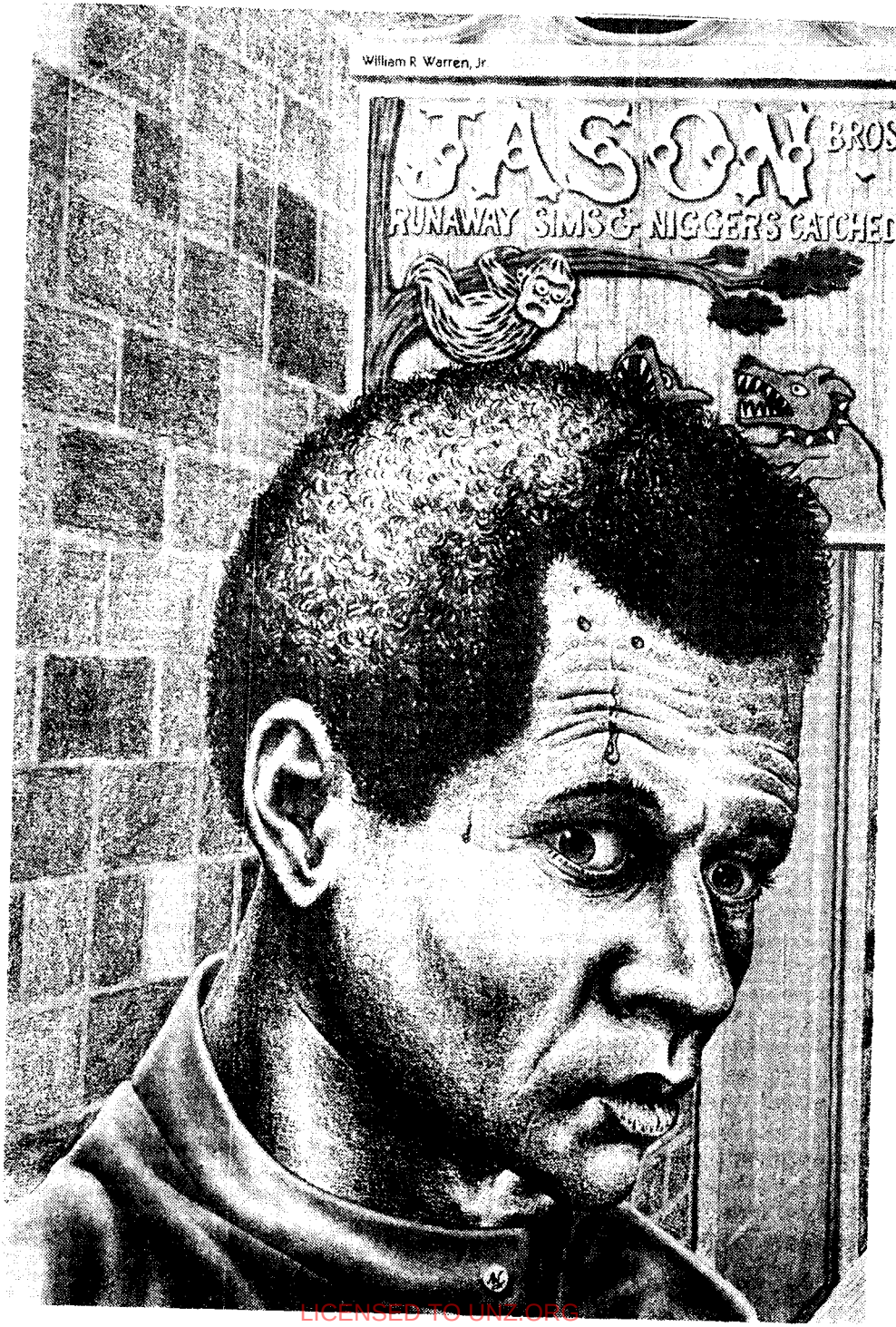

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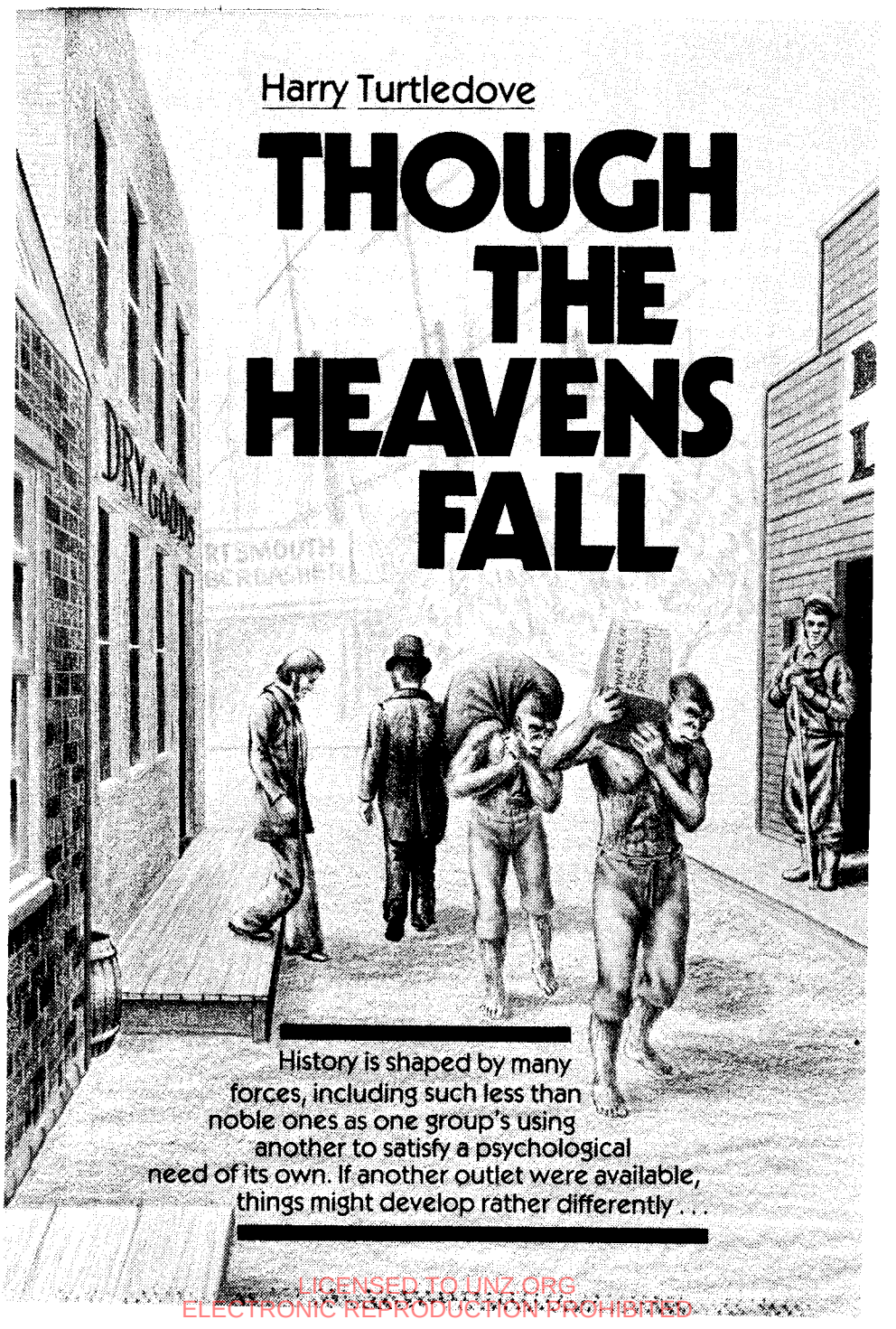
Harry Turtledove

THOUGH THE HEAVENS FALL



History is shaped by many forces, including such less than noble ones as one group's using another to satisfy a psychological need of its own. If another outlet were available, things might develop rather differently . . .

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Jeremiah swept the feather-duster over the polished top of his master's chest of drawers. Moving slowly in the building heat of a May Virginia morning, he raised the duster to the mirror that hung above the chest.

He paused to look at himself; he did not get to see his reflection every day. He raised a hand to brush away some dust stuck in his wooly hair. His eyeballs and, when he smiled, his white, even teeth gleamed against the polished ebony of his skin.

"You, Jeremiah!" Mrs. Gillen called from the next room. "What are you doing in there?"

"Dusting, ma'am," he answered, flailing about with the feather-duster so she would see him busy if she came in to check. Unlike the sims that worked in the fields, house-slaves rarely felt the whip, but he did not intend to tempt fate.

All Mrs. Gillen said, though, was, "Go downstairs and fetch me up a glass of lemonade. Squeeze some fresh; I think the pitcher's empty."

"Yes, ma'am." Jeremiah sighed as he went to the kitchen. On a larger estate, other blacks would have shared the household duties. Here he was cook, cleaner, butler, coachman by turns, and busy all the time because there was so much to do.

He made a fresh pitcher of lemonade to his own taste, drank a glass, then added more sugar—the Gillens liked it sweeter than he did.

"Took you long enough," Jane Gillen snapped when he got upstairs. He took no notice of it; that was simply her way. She was in her early thirties, a few years older than Jeremiah, her mousy prettiness beginning to yield to time.

"Oh, that does a body good," she said, emptying the glass and giving it back to him. "Why don't you take the rest of the pitcher out to my husband? He and Mr. Stowe are in the south field, and they'll be suffering from the sun. Go on; they'll thank you for it."

"Yes, ma'am," he said again, this time with something like enthusiasm. He returned to the kitchen, put the pitcher and two glasses on a tray, and went out to look for his master and the overseer.

A big male sim was chopping logs into firewood behind the house. It stopped for a moment to nod to Jeremiah as he went by.

He nodded back. "Hello, Joe," he said, a faint edge of contempt riding his words. He might have been a slave, but by God he was a man!

Joe did not notice Jeremiah's condescension. Muscles bulged under the thick coat of hair on the sim's arms as it swung the axe up for another stroke. The axe descended. Chips flew. One flew right over Joe's head, landed in the dust behind the sim.

Jeremiah chuckled as he walked on. Had he been wielding the axe, the chip would have caught him right in the forehead and probably made him bleed. But sims had no foreheads. Above Joe's deep-set eyes was only a beetling ridge of bone that retreated smoothly toward the back of his head.

More sims worked in the fields, some sowing hemp seeds broadcast on the land devoted to the farm's main cash crop, others weeding among the growing green stalks of wheat. They would

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have done a better job with lighter hoes, but the native American subhumans lacked the sense to take proper care of tools of good quality.

Mostly the sims worked in silence. Now and then one would let its long, chinless jaw fall open to emit a grunt of effort, and once Jeremiah heard a screech as a sim hit its own foot instead of a weed. But unlike men, the sims did not talk among themselves. Few ever mastered English, and their own grunts and hoots were too restricted to make up a real language.

Instead, they used hand-signs like the ones the deaf and dumb employed; those came easier to them than speech. Jeremiah had heard Mr. Gillen say even the wild sims that still lurked in the forests and mountains two centuries after men came to Virginia used hand-signs taught them by runaways in preference to their native calls.

Charles Gillen and Harry Stowe were standing together, watching the sims work. Gillen turned and saw Jeremiah. "Well, well, what have we here?" he said, smiling. He was a large man, about the same age as his wife, with perpetually ruddy features and a strong body beginning to go to fat.

"Lemonade, sir, for you and Mr. Stowe." Jeremiah poured for each man, handed them their glasses.

Gillen drained his without taking it from his lips; his face turned even redder than usual. "Ahh!" he said, wiping his mouth. "Now that was a kindly thought, and surely it's no part of your regular duties to go traipsing all over the farm looking for me." He rummaged through the pockets of his blue cotton breeches. "Here's a ten-sester for your trouble."

"I thank you very much, sir." Jeremiah's trousers did not have pockets. He stowed the small silver coin in a leather pouch he wore on a thong round his neck under his shirt. The hope for just such a reward was one of the things that had made him eager to go to his master. Besides, it beat working.

He did not mention that the lemonade had been Mrs. Gillen's idea. Even if her husband found out, though, he would not take the ten-sester back; he was a fair-minded man.

Harry Stowe kept his glass in his left hand as he drank. His right hand held his whip, as it always did when he was in the field. The whip was a yard-long strip of untanned cowhide, an inch thick at the grip and tapering to a point.

Stowe was a small, compact man with fine features and cold blue eyes that never stopped moving. He snarled an oath and stepped forward. The whip cracked. A sim shouted in alarm, clutched at its right arm.

"Oh, nonsense, Tom," Stowe snapped. "I didn't hurt you, and well you know it. But damn you, have more care with what you do. That was wheat you were rooting out there, not a weed."

The sim understood English well enough, even if it could not speak. Its hands moved. *Sorry,* it signed. Its broad, flat features were unreadable. When it went back to weeding, though, it soon uprooted another stalk of wheat.

Stowe's hand tightened on the butt of the whip until his knuckles whitened. But he did not lash out. His shoulders sagged. "In a man, that would be insolence," he said to Charles Gillen. "But sims cannot, will not attend as a man would. I could wear out my arm,

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my cowskin, and my temper, sir, and not improve them much."

"Your being here at all keeps them working, Harry. We shouldn't expect them to be fine farmers," Gillen replied. "When men first came to Virginia, they found the sims were unable to make fire, with no tools but chipped stones."

"You are an educated man, to know such things," the overseer said. "For myself, all I know is that they do not work as I would wish, and so waste your substance. I wish you could afford to have niggers in the fields. I would make fine farmers of *them*, I wager." He looked speculatively toward Jeremiah.

The house-slave wished he could become invisible; suddenly he was not glad at all he had come out to the fields. He stretched out his hands to his master. "Mr. Gillen, you wouldn't treat me like no sim, would you, sir?" The wobble of fear in his voice was real.

"No, no, Jeremiah, don't fret yourself," Gillen reassured him, sending a look-at-the-trouble-you-caused glance Stowe's way. "I find it hard to imagine a circumstance that would force me to use you so."

"Thank you, sir, thank you." Jeremiah knew he was laying it on thick, but he took no chances. Not only was labor in the fields exhausting, but he could imagine nothing more degrading. Even as a slave, he had a measure of self-respect. One day he hoped to be able to buy his own liberation. The ten-sester his master had given him put his private hoard over eighty denaires. Maybe he would buy land, end up owning a few sims himself. It was something to dream about, anyway. But if Gillen worked him as he would a sim, would he not think of him in the same way, instead of as a person? He might never get free then!

Why, his master had already turned his back on him and was talking politics with Stowe as if he were not there. "So whom will you vote for in the censoral elections this fall, Harry?"

"I favor Adams and Westerbrook: two men from the same party will work together, instead of us having to suffer through another five years of divided government like this last term."

"I don't know," Gillen said judiciously. "When the Conscript Fathers wrote the Articles of Independence after we broke from England in '38, they gave us two censors to keep the power of the executive from growing too strong, as it had in the person of the king. To me that says they intended the two men to be of opposing view, to check each other's excesses."

"To check excesses, aye. But I'm partial to a government that governs, not one that spends all its time arguing with itself."

Gillen chuckled. "Something to that, I suppose. Still, don't you think—"

Jeremiah stopped listening. What did politics matter to him. As a slave, he could no more vote than a sim could. His head hung as he made his slow way back to the house.

Mrs. Gillen saw him dawdling, and scolded him. She kept an eye on him the rest of the day, which meant he had to work at the pace she set, not his own. That, he thought resentfully, was more trouble than a ten-sester piece was worth. To make things worse, he burnt the ham the Gillens, Stowe, and he were

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going to have for supper. That earned him another scolding from his mistress and a contemptuous stare from the overseer.

At sunset, Stowe blew a long, unmusical blast on a bugle, the signal for the sims to come in from the fields for their evening meal. Their food was unexciting but filling: mostly barley bread and salt pork, eked out once or twice a week, as tonight, with vegetables from the garden plot and with molasses. The sims also ate whatever small live things they could catch. Some owners discouraged that as a disgusting habit (Jeremiah certainly thought it was; stepping on a well-gnawed rat tail could be counted on to make his stomach turn over). Most, like Charles Gillen, did not mind, for it made their property cheaper to feed.

"Never catch me eating rats, not if I'm starving," Jeremiah said as he blew out the candle in his small stuffy room. He listened to make sure the Gillens were asleep (Stowe had his own cottage, close by the log huts where the sims lived).

When he was sure all was quiet, the slave lifted the loose floorboard and drew out a small flask of whisky. Any sim caught with spirits was lashed till the blood ran through the matted hair on its back. Jeremiah ran the same risk, and willingly. Sometimes he needed that soothing fire in his belly to sleep.

Tonight, though, he drank the flask dry, and tossed and turned for hours all the same.

Spring gave way to summer. The big sim Joe stepped on a thorn, and died three weeks later of lockjaw. The loss cast a pall of gloom over Charles Gillen, for Joe was worth a hundred denaires.

Gillen's spirits only lifted when his son and daughter returned to the farm from the boarding schools they attended in Portsmouth, the commonwealth capital. Jeremiah was also glad to see them. Caleb was fourteen and Sally eleven; the slave sometimes felt he was almost as much a father to them as Charles Gillen himself.

But Caleb, at least, came home changed this year. Before, he had always talked of what to do when the Gillen farm was his. Jeremiah had only spoken of buying his own freedom once, a couple of years before; Caleb had looked so hurt at the idea of his leaving that he never brought it up again, for fear of turning the boy against it for good. He thought Caleb had long since forgotten.

One day, though, Caleb came up to him when the two of them were alone in the house. He spoke with the painful seriousness adolescence brings: "I owe you an apology, Jeremiah."

"How's that, young master?" the slave asked in surprise. "You haven't done nothing to me." And even if you had, he added silently, you would not need to apologize for it.

"Oh, but I have," Caleb said, "though I've taken too long to see it. Do you remember when you told me once you would like to be free and go away?"

"Yes, young sir, I do remember that," Jeremiah said cautiously. Any time the issue of liberation came up, a slave walked the most perilous ground there was.

"I was too little to understand then,"

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the boy said. "Now I think I may, because I want to go away too."

"You do? Why could that be?" Jeremiah was not pretending. This declaration of Caleb's was almost as startling as his recalling their conversation at all. To someone that young, two years was like an age.

"Because I want to read the law and set up my own shingle one day. The law is the most important thing in the whole world, Jeremiah." His voice burned with conviction; at fourteen, one is passionately certain about everything.

"I don't know about that, young master. Nobody can eat law."

Caleb looked at him in exasperation. "Nobody could eat food either, or even grow it, if his neighbor could take it whenever he had a mind to. What keeps him from it, even if he has guns and men and sims enough to do it by force? Only the law."

"Something to that," Jeremiah admitted. He agreed only partly from policy; Caleb's idea had not occurred to him. That it might be a positive good was a new notion—one easier to arrive at for a free man, he thought without much bitterness.

Enthusiasm carried Caleb along. "Of course there's something to it! People who make the law and apply the law rule the country. I don't mean just the censors or the Senate or the Popular Assembly—though one day I'll serve, I think—but judges and lawyers too."

"That may be so, young master, but what will become of the farm when you've gone to Portsmouth to do your lawyering, or up to Philadelphia for the Assembly?" Jeremiah knew vaguely where Portsmouth was (somewhere southeast, a journey of a week or two); he knew Philadelphia was some long ways north, but had no idea how far. Half as far as the Moon, maybe.

"One day Sally will get married," Caleb shrugged. "It will stay in the family. And lawyers get rich, don't forget. Who knows? Maybe one day I'll buy the Pickens place next door to retire on."

Jeremiah's opinion was that old man Pickens would have to be dragged kicking and screaming into his grave before he turned loose of his farm. He knew, however, when to keep his mouth shut. He also noticed that any talk about his freedom had vanished from the conversation.

Nevertheless, Caleb had not forgotten. One day he took Jeremiah aside and asked him, "Would you like me to teach you to read and cipher?"

The slave thought about it. He answered cautiously, "Your father, I don't know if he'd like that." Most masters discouraged literacy among their blacks (sims did not count; no sim had ever learned to read). In some commonwealths—though not Virginia—teaching a black his letters was against the law.

"I've already talked with him about it," Caleb said. "I asked him if he didn't think it would be useful to have you able to keep accounts and such. He hates that kind of business himself."

The lad already had a good deal of politician in him, Jeremiah thought. Caleb went on, "Once you learn, maybe you can hire yourself out to other farmers, and keep some of what you earn. That would help you buy yourself free sooner, and knowing how to read and figure can only help you afterwards."

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"You're right about that, young sir. I'd be pleased to start, so lóng as your father won't give me no grief on account of it."

The hope of money first impelled Jeremiah to the lessons, but he quickly grew fascinated with them for their own sake. He found setting down his name in shaky letters awe-inspiring: there it was, recorded for all time. It gave him a feeling of immortality, almost as if he had had a child. And struggling through first Caleb's little reader and then, haltingly, the Bible, was more of the same. He wished he could spend all his time over the books.

He could not, of course. Chores around the house kept him busy all through the day. Most of his reading time was snatched from sleep. He yawned and did not complain.

His stock of money slowly grew, five sesters here, ten there. Once he made a whole denaire for himself, when Mr. Pickens's cook fell sick just before a family gathering and Charles Gillen loaned him to the neighbor for the day. From anyone else, he would have expected two or even three; from Pickens he counted himself lucky to get one.

He did not save every sester he earned: a man needs more than the distant hope of freedom to stay happy. One night he made his way to a dilapidated cabin that housed a widow inclined to be complaisant toward silver, no matter who brought it.

Jeremiah was heading home, feeling pleased with the entire world (except for the mosquitoes), when the moonlight showed a figure coming down the path toward him. It was Harry Stowe. Jeremiah's pleasure evaporated. He was afraid of the overseer, and tried to stay out of his way. Too late to step aside into the bushes—Stowe had seen him.

"Evening, sir," Jeremiah said as the overseer approached.

Stowe set hands on hips, looked Jeremiah up and down. "Evening, sir," he echoed, voice mockingly high. There was whisky on his breath. "I'm tired of your uppity airs—always sucking up to young Caleb. What do you need to read for? You're a stinking slave, and don't you ever forget it."

"I could never do that, sir, no indeed. But all the same, a man wants to make himself better if he can."

He never saw the punch that knocked him down. Drunk or sober, Stowe was fast and dangerous. Jeremiah lay in the dirt. He did not try to fight back. Caleb's law descended swiftly and savagely on any slave who dared strike a white man. But here fear of punishment was not what held him back. He knew Stowe would have no trouble taking him, even in a fair fight.

"Man? I don't see any man there," the overseer said. "All I see's a nigger." He laughed harshly, swung back his foot. Instead of delivering the kick, though, he turned away and went on toward the widow's.

Jeremiah rubbed the bruise on the side of his jaw, felt around with his tongue to see if Stowe had loosened any of his teeth. No, he decided, but only by luck. He stayed down until the overseer disappeared round a bend in the path. Then he slowly rose, brushing the dust from his trousers.

"Not a man, huh?" he muttered to himself. "Not a man? Well, let that trash talk however he wants, but whose

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sloppy seconds is he getting tonight?" Feeling a little better, he headed back to the Gillen house.

Summer wore on. The wheat grew tall. The stalks bent, heavy with the weight of grain. Caleb and Sally returned to Portsmouth for school. The sims went into the fields to start cutting the hemp so it could dry on the ground.

The sickness struck them then, abruptly and savagely. Stowe came rushing in from their huts at sunrise one morning to cry to Charles Gillen, "Half the stupid creatures are down and choking and moaning!"

Gillen spilled coffee as he sprang to his feet with an oath. Fear on his face, he followed the overseer out. Jeremiah silently stepped out of the way. He understood his master's alarm. Disease among the sims, especially now when the harvest was just under way, would be a disaster from which the farm might never recover.

Jane Gillen waited anxiously for her husband to return. When he did, his mouth was set in a tight, grim line. "Diphtheria," he said. "We may lose a good many." He strode over to the cupboard, uncorked a bottle of rum, took a long pull. He was not normally an intemperate man, but what he had seen left him shaken.

As Jeremiah washed and dried the breakfast dishes, he felt a certain amount of relief, at least as far as his own risk was concerned. Sims were enough like men for such illnesses to pass from them to the people around them. But he had had diphtheria as a boy, and did not have to worry about catching it again.

A sadly shrunken work force trooped out to cut the hemp. Charles Gillen set Jeremiah boiling great kettles of soup, that being the easiest nourishment for the sick sims to get past the membranes clogging their throats. Then Gillen hurried back out to the sim quarters, to do what little doctoring he could.

The first deaths came that evening. One was Rafe, the powerful woodcutter who had replaced Joe. Not all his strength sufficed against the illness that choked the life from him. The tired sims returning from the fields had to labor further to dig graves.

"I always feel so futile, laying a sim to rest," Gillen told Jane as they ate a late supper that Jeremiah had made. "With a man, there's always the hope of heaven to give consolation. But no churchman I've ever heard of can say for certain whether sims have souls."

Jeremiah doubted it. He thought of sims as nothing more than animals that happened to walk on two legs and have hands. That made them more useful than, say, horses, but not much smarter. He rejected any resemblance between their status and his own; he at least knew he was a slave and planned to do something about it one day. His hoard had reached nearly ninety denaires.

The next day, even fewer of the sims could work. Charles Gillen rode over to the Pickens farm to see if he could borrow some, but the diphtheria was there ahead of him. Mr. Pickens was down with it too, and not doing well.

Gillen bit his lip at the small amount of hemp cut so far. Jeremiah had done just enough practice ciphering over the farm accounts to understand why: the cash Gillen raised from selling the hemp

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was what let him buy the goods his acres could not produce.

After supper that evening, Gillen took Jeremiah aside. "Don't bother with breakfast tomorrow, or with more soup for the sims," he said. "Jane will take care of all that for a while."

"Mrs. Gillen, sir?" Jeremiah stared at his master. He groped for the only explanation he could think of. "You don't care for what I've been making? You tell me what you want, and I'll see you get it."

A gentleman to the core, Gillen replied quickly, "No, no, Jeremiah, it's nothing like that, I assure you. You've done very well." Then he stopped cold, his cheeks reddening, plainly embarrassed to continue.

"You've gone and sold me." Jeremiah blurted out the first—and worst—fear that came to his mind. Every slave dreaded the announcement that would turn his life upside down. And Charles Gillen was on the whole an easygoing master; any number of tales Jeremiah had heard convinced him of that.

"I have not sold you, Jeremiah. Your place is here." Again Gillen's reply was swift and firm; again he had trouble going on.

"Well, what is it, then?" Jeremiah demanded. His master's hesitation set them in oddly reversed roles, the slave probing, seeking, Gillen trying to evade the way Jeremiah did when caught at something he knew was wrong. Having the moral high ground was a new and heady feeling.

He did not enjoy it long. Brought up short, Gillen had no choice but to answer, "I'm sending you out to the fields tomorrow, Jeremiah, to help cut hemp."

With sick misery, the slave realized he would rather have been sold. "But that's sim work, Mr. Gillen," he protested.

"I know it is, and I feel bad for it. But so many of the sims are down with the sickness, and you are strong and healthy. The hemp must be cut. It does not care what hand swings the sickle. And I will not think less of you for working in the fields—rather the contrary, because you will have helped me at a time of great need. When the day comes that you approach me to ask to buy your freedom, be sure I shall not forget."

Had he promised Jeremiah manumission as soon as the hemp-cutting was done, he would have gained a willing worker. As it was, though, the slave again protested, "Don't sent me out to do sim work, sir."

"And why not?" Gillen's voice had acquired a dangerous edge.

"Because—" Jeremiah knew he was faltering and cursed himself for it, but could not do anything about it. Charles Gillen was a decent man, as decent as a slaveowner could be, but he was also a white man. He knew himself the equal of his fellow farmers and townsmen; his son dreamed of being censor of the Federated Commonwealths one day. He was immeasurably far above both blacks and sims.

Jeremiah also felt the gulf between himself and his master, of course. Even gaining his freedom would not erase all of it—certainly not in Gillen's eyes. But Jeremiah also saw another gulf, one with him at the top looking down on the sims below.

From Charles Gillen's lofty perch,

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that one was invisible. But it was immensely important to Jeremiah. Even a slave could feel superior to the subhuman natives of America, could pride himself on things he could do that they would never be capable of. Learning his letters was something of that sort, a reminder that, even if his body was owned, his spirit could still roam free.

And now Gillen, without understanding at all what he was doing, was shoving him down with the sims, as if there were no difference between him and them. Harry Stowe would see no difference either, indeed would relish getting his hands on Jeremiah. He had made that quite clear.

That was bad enough, but the white men already looked down on Jeremiah. He had some status, though, among the blacks of the neighborhood. It would disappear the instant he went out to the fields. Even the stupid sims would laugh their gape-mouthed, empty-headed laughs at him, and think him no better than themselves. He would never be able to trust his authority over them again.

All that passed through his mind in a matter of seconds, along with the realization that none of it would make sense to Gillen, certainly not when measured against the denaires the farmer was losing every day. "It just wouldn't be right, sir," was the weak best Jeremiah could do.

He knew it was not good enough even before he saw Gillen's face cloud with anger. "How would it not be right? It pains me to have to remind you, Jeremiah, but you are my slave, my chattel personal. How I employ you, especially in this emergency, is my affair and mine alone. Now I tell you that you shall report to the field gang tomorrow at sunrise or your back will be striped and then you will report anyway. Do you follow me?"

"Yes, sir," Jeremiah said. He did not dare look at Gillen, for fear his expression would earn him the whipping on the spot.

"Well, good." Having got his way, Gillen was prepared to be magnanimous. He patted Jeremiah on the shoulder. "It will only be for a few days, a couple of weeks at most. Then everything will be back the way it was."

"Yes, sir," Jeremiah said again, but he knew better. Nothing would ever be the same, not between him and other blacks, not between him and the sims, and not between him and Gillen either. One reason Gillen was a bearable master was that he treated Jeremiah like a person. Now the thin veil of politeness was ripped aside. At need, Gillen could use Jeremiah like any other beast of burden, and at need he would. It was as simple as that.

When Jeremiah lifted the loose board in his room, he found his little flask of spirits was empty. "I might have known," he muttered under his breath. "It's been that kind of day." He blew out his candle.

He was already awake when Stowe blasted away on the horn to summon the sims—and him—to labor. He had been awake most of the night; he was too full of mortification and swallowed rage to sleep. His stomach had tied itself into a tight, painful knot.

His eyes felt as though someone had thrown sand in them. He rubbed at them

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as he pulled on breeches, shoes, and shirt and went out to the waiting overseer.

Stowe was doling out hardtack and bacon to the sims still well enough to work. "Well, well," he said, smiling broadly as Jeremiah came up. "What a pleasure to see our new fieldhand, and just in time for breakfast, too. Get in line and wait your turn."

The overseer watched for any sign of resistance, but Jeremiah silently took his place. The hardtack was a jawbreaker, and the bacon, heavily salted so it would keep almost forever, brought tears to his eyes. If his belly had churned before, it snarled now. He gulped down two dippers of water. They did not help.

The sims' big yellow teeth effortlessly disposed of the hardtack biscuits. The salt in the bacon did not faze them either. Jeremiah's presence seemed to bother them a good deal more. They kept staring at him, then quickly looked away whenever his eyes met theirs. The low-voiced calls and hoots they gave each other held a questioning note.

Those calls, though, could only convey emotion, not real meaning. For that, the sims had to use the handsigns men had given them. Their fingers flashed, most often in the gesture equivalent to a question-mark. Finally, one worked up the nerve to approach Jeremiah and sign, *Why you here?*

"To work," he said shortly. He spoke instead of signing, to emphasize to the sim that, despite his present humiliation, he was still a man.

Harry Stowe, who missed very little, noted the exchange. Grinning, he sabotaged Jeremiah's effort to keep his place by signing, *He work with you, he work like you, he one of you till job done. No different.* "Isn't that right?" he added aloud, for Jeremiah's benefit.

The slave felt his face grow hot. He bit his lip, but did not reply.

Stowe's message disturbed even the sims. One directed hesitant signs at the overseer: *He man, not sim. Why work like sim?*

"He's a slave. He does what he's told, just like you'd better. If the master tells him to work like a sim, he works like a sim, and that's all there is to it. Enough dawdling, now—let's get on with it."

The overseer distributed scythes and sickles to his charges, carefully counting them so the sims could not hold any back to use against their owners—or against each other, in fights over food or females. Jeremiah wished he had a pair of gloves; his hands were too soft for the work he was about to do.

He knew better than to ask for any.

As he started down a row of hemp plants, he saw the sims to either side quickly move past him. It was not just that they were stronger, though few men could match the subhumans for strength. They were also more skilled, which was really galling. Bend, slash, stoop, spread, rise, step, bend . . . they had a rhythm the black man lacked.

"Hurry it up, Jeremiah," Stowe said. "They're getting way ahead there."

"They know what they're doing," the slave grunted, stung by the taunt. "Turn one loose in my kitchen and see what kind of mess you'd get." To his surprise, Stowe laughed.

Jeremiah soon grew sore, stiff, and winded. He did not think he could have gone on without the half-grown sim that

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carried a bucket of water from one worker to the next. At first it would not stop for him, passing him by for members of its own kind. A growl from Stowe, though, fixed that in a hurry.

Reluctantly, Jeremiah came to see that the overseer did not use his charges with undue harshness. To have done so would have wrung less work from them, and work was what Stowe was after. He treated the sims—and Jeremiah—like so many other beasts of burden, with impersonal efficiency. The slave even wished for the malice Stowe had shown on the path that summer night. That, at least, would have been an acknowledgment of his humanity.

Before long, he found out what having such wishes granted meant. "Spread the hemp better once you cut it," Stowe snapped. Jeremiah jumped; he had not heard the overseer come up behind him. "Spread it out," Stowe repeated. "It won't dry as well if you don't."

"I'm doing as well as the sims are," Jeremiah said, nodding toward the long, sharp dark-green leaves lying to his right and left."

Stowe snorted. "I could wear out my whip arm and they'd still be slipshod. I expect better from you, and by Christ I'll get it." His arm went back, then forward, fast as a striking snake. The whip cracked less than a foot from Jeremiah's ear. He flinched. He could not help it. "The next one you'll feel," the overseer promised. He paused to let the message sink in, then moved on to keep the sims busy.

Jerermiah had a shirt of dark green silk. He mostly wore it for show, when his master was entertaining guests. He had never noticed it was the exact color of hemp leaves. Now he did, and told himself he would never put it on again.

The day seemed endless. Jeremiah did not dare look at his hands. He did know that, when he shifted them on the handle of the sickle, he saw red-brown stains on the gray, smooth wood.

Craack! "God damn you, Jeremiah, I told you what I wanted!" Stowe shouted. The slave screamed at the hot touch of whip on his back. "Oh, stop your whining," the overseer said. "I've not even marked you, past a bruise. You keep provoking me, though, and I'll give you stripes you'll wear the rest of your life."

Several sims watched the byplay, taking advantage of Stowe's preoccupation to rest from their labor. *Work more, work better,* one signed at Jeremiah. Its wide, stupid grin was infuriatingly smug.

"Go to the devil," Jeremiah muttered. For once, he hoped sims had souls, so they could spend eternity roasting in hellfire.

He thought the day would never end, but at last the sun set. "Enough!" Stowe shouted. This time Jeremiah had no trouble understanding the sims' whoops. He felt like adding some himself.

Stowe collected the tools, counting them as carefully as he had in the morning to make sure none was missing. His chilly gaze swung toward Jeremiah. "I'll see you tomorrow come sunrise. Now that you know what to do, I won't have to go easy on you any more." The whip twitched in his hand, ever so slightly.

"No, sir, Mr. Stowe, you surely won't," Jeremiah said. The overseer nodded, for once satisfied.

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Jeremiah had been afraid he would have to sleep in the sim barracks, but Stowe did not object when he went back to his room in the big house. Probably hadn't thought of it, the slave decided. He stopped at the kitchen for leftovers from the meal Jane Gillen had cooked. They were better than what the sims ate, but not much. His lip curled; he had forgotten more about cooking than Mrs. Gillen knew.

His hands felt as if they were on fire. He could not ignore them any more. There was a crock of lard in the kitchen. He rubbed it into both palms. The fat soothed the raw, broken skin.

His back twinged again when he took off his shirt. Stowe knew exactly what he was doing with a lash, though; he had not drawn blood. But Jeremiah remembered the overseer's warning. His aching muscles contracted involuntarily, as if anticipating a blow that was sure to come.

Looking back, Jeremiah thought that unwilled, mortifying twinge was what made him do what he did next. "I don't care how white he is, he ain't gonna get the chance to whip me again," he said out loud. He put his shirt back on, took out the pouch with his hard-saved sesters and denaires, opened the door, stepped into the hallway, shut the door behind him.

He could have gone back with no one the wiser, but from that moment on he was irrevocably a runaway in his own mind. Being one, he stopped in the kitchen again, to steal a carving knife. He had held that blade in his hand a hundred times with the Gillens or their children close by, and never thought of lifting it against them. "No more," he whispered. "No more."

And yet, as he left the dark and quiet house, he had trouble fighting the paralyzing tide of fear that rose inside him. He had his place here, his known duties and expectations. His master had let him earn the money he was carrying just so he could buy his freedom one day.

He turned back. His hand was on the doorknob when the pain that light touch brought returned him to his purpose. How was it really his place, he wondered, if Gillen would take it from him whenever he chose?

The question had no answer. He walked down the wooden steps and into the night.

Eleven days later, he came down the West Norfolk Road into Portsmouth. He was ragged and dirty and thin and tired; only on the last day had he dared actually travel the highway. Before that, fearing dogs and hunters on his track, he had gone by winding, back country paths and through the woods.

Those held terrors of their own. Spearfangs had been hunted almost to extinction in Virginia years ago. Almost, however, was the operative word; Jeremiah had spent an uncomfortable night in a tree because of a thunderous coughing roar that erupted from the undergrowth a few hundred yards to his left.

He also had an encounter with a wild sim. It was hard to say which of the two got a worse fright from it. In the old days, Jeremiah had heard, sims would hunt down and eat any men they could catch. But now, brought low by gunpowder and by man's greater native wit,

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the wild sims were only skulking pests in the land they had once roamed freely. And when this one saw the knife Jeremiah jerked out, it hooted and fled before it had a chance to hear his teeth chattering.

After those adventures and a couple more like them, he wished he had taken his chances on hounds and trackers. With them, at least, he knew what to expect.

Portsmouth was the biggest town he had ever seen, ever imagined. By the bay, masts of merchantmen and naval vessels made a bare-branched forest against the sky. The gilded dome of the commonwealth capital dominated the skyline. Jeremiah did not know that was what it was. He only knew it was grand and beautiful.

People of every sort swarmed through the streets, paying no attention to one more newly arrived, none too clean black man. Even the four sims bearing a rich trader's sedan chair looked down their broad, flat noses at him. And no wonder, he thought. Charles Gillen was a long way from poor, but he did not own a suit of clothes half so fine as the matched outfits of silk and satin the sims were wearing.

Jeremiah blessed the half thought out notion that had brought him to the city. Among these thousands, how could anyone hope to find one person in particular? His confidence took a jolt, though, for he passed a cabin whose sign declared: "JASON BROS: RUNAWAY SIMS AND NIGGERS CATCHED." The picture below showed a sim treed by hounds with improbably sharp teeth and red mouths. Jeremiah shuddered and hurried on.

Before long, his stomach forced him to face another problem. On the road, he had raided fruit-trees and stolen a couple of chickens, eking them out with fruits and berries. He did not think he could get away with that kind of provisioning for long in Portsmouth. Food was harder to get at and thieves more likely to be hunted down. He could eat for a while on the money he had with him, but he would have to find work if he did not want to deplete it. The twenty sesters he paid for a bad breakfast only reinforced the truth of that.

Here he would not have turned down the kind of hard manual labor that had made him run away in the first place. He would have been doing it for himself, of his own free will, and he reasoned that employers who only wanted strong backs would ask few questions.

But no such hauling or digging or carrying jobs were to be had: sims did them all, for no more wages than their keep. "You must be just off the farm, to think you can get that kind of job and get paid for it," a strawboss said. Jeremiah's heart leapt into his mouth, but the man went on, "If you have a skilled trade, now, like carpenter or mason, I can use you. How about it?"

Jeremiah had used saw and chisel and plane often enough on the Gillen estate, but he said, "Sorry, sir, no," and left in a hurry. The strawboss's chance reference to his real status, even if nothing was behind it, made him too nervous to stay.

He wandered aimlessly through Portsmouth for a while, marveling at the number of buildings that would have dwarfed the Gillen house, till then the grandest he had known. One imposing

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marble structure near the capitol had an inscription over the columned entranceway. It was in large, clear letters, but even when he spelled it out twice it made no sense: FIAT IUSTITIA ET RUANT COELI. He shrugged and gave it up.

Not far away, down a winding side street, stood a dilapidated clapboard building with a sign nailed to the front door. The sign was hard to read because it needed painting, but the words, at least, made sense: ALFRED P. DOUGLAS, ATTORNEY AT LAW.

Jeremiah was about to pass on by when he remembered Caleb Gillen's talk about lawyers and how important they were. Maybe an important man would have work for him. And if the important man got too nosy, well, important men tended to be fat, and he could probably outrun this one. He walked up and knocked on the door.

"It's open," someone with a deep voice called from inside. He sounded important. Jeremiah turned the knob and walked in.

The man rummaging through the pile of books by his desk was fat, but that ended his resemblance to anything Jeremiah had imagined. He was about thirty, with a straggling mustache and a thick shock of greasy black hair. His breeches had a hole in the knee; one shoe had a hole in the sole. His shirt was no cleaner than Jeremiah's.

Whatever he was digging for, he must have decided he wasn't going to find it. He made a disgusted face, looked up at Jeremiah. "And what can I do for you today, sir?"

Jeremiah almost fled, as he had from the strawboss. No white man had ever called him sir, even in mockery. This did not sound like mockery. He took a chance, stayed. "I'm looking for work from you, sir."

"I'm sorry; I don't need a clerk right now." Douglas muttered something to himself that Jeremiah did not catch.

"I didn't mean that kind of work, sir." Jeremiah tried to keep his mouth from falling open. The fellow thought he wanted to study law under him! "I meant cleaning, cooking, straightening up." He looked around. "You'll excuse me for speaking so bold, sir, but this place could do with some straightening up."

Douglas grunted. "You're right, sir; as I said just now"—that must have been the mutter—"what I need is someone to make sense of this mess. You'll not be able to do that, I promise, if you have no letters."

"I can read, sir, some, and write a bit," Jeremiah said, and then had the wit to add as an afterthought, "Mr Douglas."

Douglas grunted again. "You slave or free?"

Ice ran down Jeremiah's back. "Free," he answered, and got ready to bolt if Douglas asked for papers to prove it.

All the lawyer said, though, was, "Good. I'd sooner line your pockets than your master's. What do I call you?"

"Jeremiah." Realizing a second too late that if he was free he should also have a surname, he gave the first one that popped into his head. "Jeremiah, uh, Gillen."

Douglas showed no sign of noticing the slip. He plopped his bulk into an overstuffed armchair. The springs

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groaned in protest. "All right, Mr. Gillen, I'll try you, damn me if I don't. Put that stack there into some kind of order and I'll take you on."

The stack was the one the lawyer had been pawing through. Jeremiah knelt beside it. He almost gave up at once, for the books' titles were full of long, incomprehensible words: legal terms, he supposed. But before panic set in, he remembered the ABC Caleb Gillen had drilled into him, and the way Caleb's father kept the books in his library. If he arranged these alphabetically by author, he could not go far wrong.

"Here you are, sir," he said a few minutes later. He held out a handful of coins. "And here are the, uh, 91 sesters mixed in with the books."

Douglas stared, then burst into laughter. "Keep them, my friend, keep them, I'd say you've earned them, the more so as I'd long since forgotten they were there. It was honest of you to offer them back, but then who wouldn't be honest with a prospective employer watching?" That last so perfectly summed Jeremiah's thoughts when he found the money that he eyed Douglas with fresh respect.

The lawyer took more care inspecting the books than he had over the coins. He had to correct a mistake Jeremiah had made, and the black's heart sank for fear he would be turned down. But all Douglas said was, "Be more careful next time. Three denaires a week suit you?"

"Yes, sir!" The wage was a long way from kingly, but Jeremiah did not feel sure enough of himself to bargain. If he bought fresh food and did his own cooking, he thought he could scrape by.

Then Douglas went on, "You cook, you say?" At Jeremiah's nod, he broke into a grin that turned his heavy features boyish for a moment. "Then board with me, why don't you? I've rattled round my house since the swamp fever took my Margaret two years ago." The memory made him somber again. "Help me keep the place neat, and I'll buy supplies for both of us. You deal with them then: if I'm not the worst cook in the commonwealth, he's not been born yet. Do we have a contract?"

"A deal, you mean? Yes, sir!" Jeremiah clasped Douglas' outstretched hand. The lawyer's grip was soft but strong. Jeremiah felt like turning handsprings. With room and board taken care of, three denaires wasn't bad money at all.

Jeremiah spent the rest of the day getting things off the floor so he could sweep it clean of crumpled papers, dust, apple cores, nutshells, and other garbage. Douglas's indifference to filth left his fastidious soul cringing.

He found another denaire and a half in loose change. The lawyer let him keep that too, though he warned, "Bear in mind my generosity doesn't extend to gold, if there is any down there." The thought of coming across a gold-piece made Jeremiah work harder than ever; only later did he think to wonder whether that was what Douglas had in mind.

He had got down to bare wood in a few places when Douglas had a visitor, a tall, lean, middle-aged man who wore a stovepipe hat to make himself seem even taller. "Ah, Mr. Hayes," Douglas

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said, setting aside the document he had been studying. "What can I do for you, this fine afternoon?"

Hayes glanced at Jeremiah. "Buy yourself a nigger? Doesn't seem like you, Alfred."

"He's free; I hired him," Douglas said, his color rising. "Mr. Hayes, Jeremiah Gillen. Jeremiah, this is Zachary Hayes." Hayes nodded with the minimum courtesy possible and did not offer to shake hands. Jeremiah went back to work. He was not used to respect from whites, and did not miss it.

"I came on a gamble," Hayes said, turning away from Jeremiah with obvious relief. "I daresay you own the most law books in the city, and keep them in the worst order. Have you a copy of William Watson's *Ten Quodlibetical Questions Concerning Religion and State* and, if so, can you lay your hands on it?"

"The title rings a bell—having heard it, how could one forget it?" Douglas said. "As for where it might be, though, I confess I have no idea. Jeremiah, paw through things and see what you come up with, will you?"

Hayes made a sour face and folded his arms to wait, plainly not expecting Jeremiah to find the book. That scorn spurred him more even that Douglas's earlier mention of gold. He dove under tables, climbed on a shaky chair to reach top bookcase shelves. On one of those, its calfskin spine to the wall, he found Watson's tome. He wordlessly handed it to Hayes.

"My thanks," Hayes said—not to him, but to Douglas. "I'll have it back to you within a fortnight." He spun on his heel and strode out.

Douglas and Jeremiah looked at each other. They started to laugh at the same time. "Don't mind him," the lawyer said, clapping Jeremiah on the back. "He thinks niggers are stupid as sims. Come on; let's go home."

The house almost made Jeremiah regret his new employment. Douglas had spoken of helping to keep the place neat; only someone with his studied disdain for order would have imagined there was any neatness to maintain. The house bore a chilling resemblance to his office, except that dirty clothes and dirtier pots were added to the mix.

The only thing that seemed to stand aloof from the clutter was a fine oil of a slim, pale, dark-eyed woman. Douglas saw Jeremiah's eyes go to it. "Yes, that's my Margaret," he said sadly: as Jeremiah would learn, he never spoke of her without putting the possessive in front of her name.

The kitchen was worse than the rest of the house: stale bread, moldy flour, greens limp at best, and salt pork like the stuff Charles Gillen's sims ate. Jeremiah shook his head; he had looked for nothing better. He pumped some water, set a chunk of pork in it to soak out some of the salt. Meanwhile, he got a fire going in the hearth. The stew he ended up producing would have earned harsh words from his former owner, but Douglas demanded seconds and showered praise on him.

"Let me start with good food, sir, and I'll really give you something worth eating," Jeremiah said.

"I don't know whether I should, or in six months I'll be too wide to go through my own front door," Douglas said, ruefully surveying his rotund form.

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Jeremiah had to sweep off what he was coming to think of as the usual layer of junk to get at his cot. It was saggy and lumpy, nowhere near as comfortable as the one he'd had on the Gillen estate. He didn't care. It was his because he wanted it to be, not because it had to be.

He slept wonderfully.

As the months went by, he tried more than once to find a name for his relationship with Alfred Douglas. It was something more than servant, something less than friend. Part of the trouble was that Douglas treated him unlike anyone ever had before. For a long while, because he had never encountered it before, he had troubled recognizing the difference. The lawyer used him as a man, not as a slave.

That did not mean he did not tell Jeremiah what to do. He did, which further obscured the change to the black man. But he did not speak as to a half-witted, surly child, and he did not stand over Jeremiah to make sure he got things done. He assumed Jeremiah would, and went about his own business.

Not used to such liberty, at first Jeremiah took advantage of it to do as little as he could. "Work or get out," Douglas told him bluntly. "Do you think I hired you to sit on your arse and sleep?"

But he never complained when he caught Jeremiah reading, which he did more and more often. In the beginning that had been purely practical on Jeremiah's part, so as to keep fresh what Caleb Gillen had taught him. Then the printed page proved to have a seductive power of its own.

Which is not to say reading came easy. It painfully taught Jeremiah how small his vocabulary was. Sometimes he could figure out what a new word meant from context. Most of the time, he would have to ask Douglas.

" 'Eleemosunary'?" The lawyer raised his eyebrows. "It's a fancy word for 'charitable.' " He saw that meant nothing to Jeremiah either, simplified again: " 'Giving to those who lack.' What are you looking at, anyhow?"

Jeremiah held up a law book, wondering if he was in trouble. Douglas only said "Oh" and returned to the brief he was drafting. When he was done, he sanded the ink dry, set the paper aside, and pulled a slim volume from the shelf (by this time, things were easy to find).

He offered the book to Jeremiah. "Here, try this. You have to walk before you can run."

"*The Articles of Independence of the Federated Commonwealths and the Terms of Their Federation,*" Jeremiah read aloud.

"All else springs from those," Douglas said. "Without them, we'd have only chaos, or a tyrant as they do these days in England. But go through them and understand them point by point, and you've made a fair beginning toward becoming a lawyer."

Jeremiah stared at him. "There's no nigger lawyers in Portsmouth." He spoke with assurance; he had got to know the black part of town well. It boasted scores of preachers, a few doctors, even a printer, but no lawyers.

"I know there aren't," Douglas said. "Perhaps there should be." When Jeremiah asked him what he meant, Douglas changed the subject, as if afraid he had said too much.

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The book Douglas gave Jeremiah perplexed and astonished him at the same time. "This is how the government is put together?" he asked the lawyer after he had struggled through the first third.

"So it is." Douglas looked at him keenly, as if his next question was to be some kind of test. "What do you think of it?"

"I think it's purely crazy, begging your pardon," Jeremiah blurted. Douglas said nothing, waiting for him to go on. He fumbled ahead, trying to clarify his feelings: "The censors each with a veto on the other one, the Popular Assembly chose by all the free people and the Senators by—I forget how the Senators happen."

"Censors and commonwealth governors become Senators for life after their terms end," Douglas supplied.

Jeremiah smacked his forehead with the heel of his hand. "That's right. And the censors enforce the laws and lead the armies, but only if the Senate decides to spend the money the armies need. And it's the Popular Assembly that makes the laws (if the Senate agrees) and decides if it's peace or war in the first place. If you ask me, Mr. Douglas, I don't think any one of 'em knows for certain he can fart without checking the *Terms of Federation* first."

"That's also why we have courts," Douglas smiled. "Why do you suppose the Conscript Fathers arranged things this way? Remember, after we won our freedom from England, we could have done anything we wanted."

Having had scant occasion to think about politics before, Jeremiah took a long time to answer. When he did, all he could remember was the discussion Charles Gillen and Harry Stowe had had the spring before. "For the sake of argufying?" he guessed.

To his surprise, Douglas said, "You know, you're not far wrong. They tried to strike a balance, so everyone would have some power and no one group could get enough to take anybody else's freedom away. The Conscript Fathers modeled our government on the mixed constitution the Roman Republic had. You know who the Romans were, don't you, Jeremiah?"

"They crucified Jesus, a long time ago," Jeremiah said, exhausting his knowledge of the subject.

"So they did, but they were also fine lawyers and good, practical men of affairs—not showy like the Greeks, but effective, and able to rule a large state for a long time. If we do half so well, we'll have something to be proud of."

The discussion broke off there, because Zachary Hayes came in to borrow a book. Now that Jeremiah had Douglas's library in order, Hayes stopped by every couple of weeks. He never showed any sign of recognizing why he had more luck these days, and spoke directly to Jeremiah only when he could not help it.

This time, he managed to avoid even looking at the black man. Instead, he said to Douglas, "If you don't mind, you'll see me more often, Alfred. I've a new young man studying under me, and long since gave away my most basic texts."

"No trouble at all, Zachary," Douglas assured him. Once Hayes was gone, Douglas rolled his eyes. "That buzzard never gave anything away, except maybe the clap. I guarantee you he sold his old

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books—probably for more than he paid for them too; no denying he's able."

Jeremiah did not answer. He was deep in the *Terms of Federation* again. Once the Conscript Fathers had outlined the Federated Commonwealths' self-regulating government, they went on to set further limits on what it could do.

Reading those limits, Jeremiah began to have a sense of what Douglas had meant by practical ruling. Each restriction was prefaced by a brief explanation of why it was needed: "Establishing dogmas having proven in history to engender civic strife, followers of all faiths shall be forever free to follow their own beliefs without let or hindrance." "So that free men shall not live in fear of the state and its agents and form conspiracies against them, no indiscriminate searches of persons or property shall be permitted." "To keep the state from the risk of tyranny worse than external subjugation, no foreign mercenaries shall be hired, but liberty shall depend on the vigilance of the free men of the nation."

On and on the book went, checking the government for the benefit of the free man. Jeremiah finished it with a strange mixture of admiration and anger. So much talk of freedom, and not a word against slavery! It was as though the Conscript Fathers had not noticed it existed.

Conscious of his own daring, Jeremiah remarked on that to Douglas. The lawyer nodded. "Slavery has been with us since Greek and Roman times, and you can search the Bible from one end to the other without finding a word against it. And, of course, when Englishmen came to America, they found the sims. No one would say the sims should not serve us."

Jeremiah almost blurted, "But I'm no sim!" Then he remembered Douglas thought him free. He did say, "Sims is different than men."

"There you are right," Douglas said, sounding uncommonly serious. "The difference makes me wonder about our laws at times, it truly does." Jeremiah hoped he would go on, but when he did, it was not in the vein the black had expected: "Of course, one could argue as well that the sims' manifest inequality only points up subtler differences between various groups of men."

Disgusted, Jeremiah found an excuse to knock off early. One thing he had learned about lawyers was that they delighted in argument for its own sake, without much caring about right and wrong. He had thought Douglas different, but he seemed the same as the rest.

A gang of sims came by, moving slowly under the weight of the heavy timbers on their shoulders. He glowered at their hairy backs. Too many white men were like Zachary Hayes, lumping sims and blacks together because most blacks were slaves.

As it had back on Charles Gillen's estate, that rankled. He was no subhuman . . . and if Hayes doubted what blacks really were, let him get a sim instead of the fancy cook he owned! Soon enough he'd be skeletal, not just lean. Jeremiah grinned, liking the notion.

Another party of sims emerged from a side street. This group was carrying sacks of beans. Neither gang made any effort to get out of the other's way. In

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an instant, they were hopelessly tangled. Traffic snarled.

Because all the sims had their hands full, they could not use their signs to straighten out the mess. Their native hoots and calls were not adequate for the job. Indeed, they made matters worse. The sims glared at each other, peeling back their lips to bare their big yellow teeth and grimacing horribly.

"Call the guards!" a nervous man shouted, and several others took up the cry. Jeremiah ducked down an alleyway. He had seen enough of sims' brute strength on the farm to be sure he wanted to be far away if they started fighting.

The town did not erupt behind him, so he guessed the overseers had managed to put things to rights. A few words at the outset would have done it: "Coming through!" or "Go ahead; we'll wait." The sims did not have the words to use.

"Poor stupid bastards," Jeremiah said, and headed home.

"Mr. Douglas, you have some of the strangest books in the world, and that is a fact," Jeremiah said.

Douglas ran his hands through his oily hair. "If you keep excavating among those boxes, God only knows what you'll come up with. What is it this time?"

"*A Proposed Explication of the Survival of Certain Beasts in America and Their Disappearance Hereabouts*, by Samuel Pepys." Jeremiah pronounced it *pep-eeze*.

"*Peeps,*" Douglas corrected, then remarked, "You know, Jeremiah, you read much better now than you did when you started working for me last summer. That's the first time you've slipped in a couple of weeks, and no one could blame you for stumbling over that tongue-twister."

"Practice," Jeremiah said. He held up the book. "What is this, anyhow?"

"It just might interest you, come to think of it. It's the book that sets forth the transformational theory of life: that the kinds of living things change over time."

"That's not what the Bible says."

"I know. Churchmen hate Pepys's theories. As a lawyer, though, I find them attractive, because he presents the evidence for them. *Genesis* is so much hearsay by comparison."

"You never were no churchgoing man, sir," Jeremiah said reproachfully. He started to read all the same; working with Douglas had given him a good bit of the lawyer's attitude. And he respected his boss' brains. If Douglas thought there was something to this —what had he called it?— transformational theory, there probably was.

The book was almost 150 years old, and written in the ornate style of the seventeenth century. Jeremiah had to ask Douglas to help him with several words and complex phrases. He soon saw what the lawyer meant. Pepys firmly based his argument on facts, with no pleading to unverifiable "authorities." Despite himself, Jeremiah was impressed.

Someone squelched up the walk toward Douglas's door: no, a couple of people, by the sound. It was that transition time between winter and spring. The rain was still cold, but Jeremiah

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knew only relief that he did not have to shovel snow any more.

Douglas had heard the footsteps too. He rammed quill into inkpot and started writing furiously. "Put Pepys down and get busy for a while, Jeremiah," he said. "It's probably Jasper Carruthers and his son, here for that will I should've finished three days ago. Since it's not done, we ought at least to look busy."

Grinning, Jeremiah got up and started reshelving some of the books that got pulled down every day. He had his back to the door when it swung open, but heard Douglas's relieved chuckle.

"Good to see you, Zachary," the lawyer said. "Saves me the embarrassment of pleading guilty to nonfeasance."

Hayes let out a dry laugh. "A problem we all face from time to time, Alfred; I'm glad you escaped it here. Do you own an English version of Justinian's *Digest*? I'm afraid the Latin of my young friend here isn't up to his reading it in the original."

The volume happened to be in front of Jeremiah's face. He pulled it from the shelf before Douglas had to ask him for it, turned with a smug smile to offer it to Hayes's student.

The smile congealed on his face like fat getting cold in a pan. The youngster with Hayes was Caleb Gillen.

The tableau held for several frozen seconds, the two of them staring at each other while the lawyers, not understanding what was going on, stared at them both.

"Jeremiah!" Caleb exclaimed. "It's my father's runaway nigger!" he shouted to Hayes at the same moment Jeremiah bolted for the door.

Pepys's book proved his undoing. It went flying out from under his foot and sent him sprawling. Caleb Gillen landed on his back. Before he could shake free of the youngster, Hayes also grabbed him. The lawyer was stronger than he looked. Between them, he and Caleb held Jeremiah pinned to the floor.

Panting, his gray hair awry, Hayes said, "You told me he was a free nigger, Alfred."

"He said he was. I had no reason to doubt him," Douglas answered calmly. He had made no move to rise from his desk and help seize Jeremiah, or indeed even to put down his quill. Now he went on, "For that matter, I still have no reason to do so."

"What? I recognize him!" Caleb Gillen shouted, his voice breaking from excitement. "And what if I didn't? He ran! That proves it!"

"If I were a free nigger and someone said I was a slave, I'd run too," Douglas said. "Wouldn't you, young sir? . . . I'm sorry; I don't know your name. . . . Wouldn't you, Zachary, regardless of the truth or falsehood of the claim?"

"Now you just wait one minute here, Alfred," Hayes snapped. "Young master Caleb Gillen here told me last year of the absconding from his father's farm of their nigger, Jeremiah. My only regret is not associating the name with this wretch here so he could have been recaptured sooner." He twisted Jeremiah's arm behind his back.

"That you failed to do so demonstrates the obvious fact that the name may be borne by more than one individual," Douglas said.

"You see here, sir," Caleb Gillen said. "I've known that nigger as long

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as I can remember. I'm not likely to make a mistake about who he is."

"If he is free, he'll have papers to prove it." Hayes wrenched on Jeremiah's arm again. The black gasped. "Can you show us papers, nigger?"

"You need not answer that, save in a court of law," Douglas said sharply, keeping Jeremiah from surrendering on the spot. He was sunk in despair, tears dripping from his face to the floor. Once sent back to the Gillen estate, he would never regain the position of trust that had let him escape, and probably never be able to buy his freedom either.

Hayes's voice took on a new note of formality. "Do you deny, then, Alfred, that this nigger is the chattel of Charles Gillen, Caleb's father?"

"Zachary, one lad's accusation is no proof, as well you know." Douglas took the same tone; Jeremiah recognized it as lawyer-talk. A tiny spark of hope flickered. By illuminating the dark misery that filled him, it only made that misery worse.

Overriding Caleb Gillen's squawk of protest, Hayes said, "Then let him be clapped in irons until such time as determination of his status may be made. That will prevent any further disappearances."

"I have a better idea," Douglas said. He unlocked one of his desk drawers, took out a strongbox, unlocked that. "What would you say the value of a buck nigger of his age would be? Is 300 denaires a fair figure?"

Above him, Jeremiah felt Caleb and Hayes shift as they looked at each other. "Aye, fair enough," Hayes said at last.

Coins clinked with the sweet music of gold. After a bit, Douglas said, "Then here are 300 denaires for you to acknowledge by receipt, to be forfeit to Master Gillen's father if Jeremiah should flee before judgment. Do you agree to this bond? Jeremiah, will you also agree to that condition?"

"Caleb, the decision is yours," Hayes said.

"Jeremiah, will you give your word?" the boy asked. He waved aside Hayes's protest before it had well begun, saying, "I've known him to be honest enough, even if a runaway." He slightly emphasized *known*, and glanced toward Douglas, who sat impassive.

"I won't run off from here, I promise," Jeremiah said wearily.

"Get off him; let him up," Caleb said. He did so himself; Hayes followed more slowly. Jeremiah rose, rubbing at bruises and at a knee that still throbbed from hitting the floor.

"May I borrow your pen?" Hayes asked Douglas. When he got it, he wrote a few quick lines, handed the paper to the other lawyer. "Here is your receipt, sir. I hope it suits you?"

"Be so good as to line out the word 'absconder' and initial the change, if you please. It prejudges a case not yet decided."

Hayes snorted but did as he was bid. Douglas dipped his head in acknowledgment. After taking up the money, Hayes said, "Come along, Master Gillen. If Alfred wants to play this game, we shall settle it in court, never fear. Oh, yes—don't forget the copy of the *Digest* your nigger was kind enough to find for you." With that parting shot, he and Caleb swept out of the office.

Jeremiah stared miserably at the floor. Douglas said, "I suppose it's no good

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asking for a miracle: you don't happen to be a free nigger named Jeremiah who just coincidentally looks exactly like that lad's father's nigger Jeremiah?"

"No, sir," Jeremiah muttered, still not looking up.

"Well, we'll have to try a different tack, then," Douglas said. He did not sound put out; if anything, he sounded eager.

More than anything else, that made Jeremiah lift his head. "You purely crazy, Mr. Douglas, sir? They'll have me in irons and hauled away fast as the judge can bang his gavel."

"Maybe, maybe not." Douglas remained ponderously unruffled.

"Shit!" Jeremiah burst out. "And *why did you give your bond on me?* I could've broke out of jail maybe, gone somewheres else. How can I run off now?"

Douglas chuckled. "Caleb Gillen's right: you are honest enough, even if a runaway. If that were me in your shoes, I'd've been out the door like a shot, no matter what promises I made. But I gambled you wouldn't, because I think we just might get you really free yet."

"You're crazy, Mr. Douglas," Jeremiah repeated. A few seconds later, he asked in a small voice, "Do you really think so?"

"We just might."

"I'd give anything! I'll pay you. I've got 150 denaires saved up, almost. You can have 'em. If I'm free, I can make more." Jeremiah knew he was babbling, but could not help it.

"You'll stay, knowing that if we lose you'll be re-enslaved?"

That was a poser. At last, Jeremiah said, "Even if I run, someone'll always be after me to drag me back. If we win, I won't have to look over my shoulder every time I sit with my back to the door. That's worth something."

"All right, then. I'll take your money. Not only do I need it after going bond for you, but having it in my pocket will give you an incentive to stay in town." Douglas looked knowingly at Jeremiah.

The black felt his cheeks go hot. Maybe he really was honest; once Douglas had given Hayes the money, it had not occurred to him that he could still run away. Once admitted, however, the idea was in his head for good. If things looked grim enough in court, he told himself, he might yet disappear.

For the life of him, he could not see how the upcoming hearing could do anything but send him back to Charles Gillen. After all, he was an escaped slave. He did not doubt his master could prove it. So why was Douglas willing to take the case before the judges?

When Jeremiah got up the nerve to ask, Douglas did not answer right away. He heaved his bulk up out of the chair, walked over to pick up the volume of Pepys the black had tripped on when he tried to escape. He examined it carefully to make sure it had not been damaged. Then he came over and slapped Jeremiah on the shoulder. "Be a man," he said. "Be a man, and we'll do all right."

True spring sweetened the air as Jeremiah and Douglas made their way to the Portsmouth courthouse. Jeremiah pointed up at the inscription over the entrance, the one that had baffled him when he arrived in the city. "What does that mean?" he asked Douglas.

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"*Fiat iustitia et ruant coeli*?" The lawyer seemed surprised for a moment at his ignorance, then laughed. "Well, no reason to blame you for knowing even less Latin than Caleb Gillen, is there? It means, 'Let there be justice, though the heavens fall.' "

Jeremiah admired the sentiment without much expecting to find it practiced. If there were justice, he would not be a slave, but he had a fatalistic certainly he soon was going to be again. Douglas's optimism did little to lighten his gloom. Douglas was always an optimist. Why not, Jeremiah thought bitterly. *He* was free.

A sim with a broom scurried out of the way to let Jeremiah pass. His spirits lifted a little. Even as a slave, he had known there was more to him than to any of the subhumans. His shoulders straightened.

He needed that small encouragement, for he felt how hostile the atmosphere was as soon as he followed Douglas into the courtroom. Hayes had made sure the case was constantly tried in the newspapers in the month since it began. Prosperous-looking white men filled most of the seats: slaveowners themselves, Jeremiah guessed from the way they glared at him. Free blacks had only a few chairs; more stood behind the last row of seats.

Hayes, Charles and Caleb Gillen, and Harry Stowe were already in their places in front of the Judges' tribunal. Jeremiah tried to read the elder Gillen's face. The man who had owned him for so long sent him a civil nod. He thought about pretending he did not recognize him, decided it would do no good, and nodded back. Hayes, who missed very little, noticed; he smiled a cold smile. Jeremiah grimaced.

"Rise for the honorable judges," the bailiff intoned as the three-man panel filed in from their chambers. In their black robes and powdered wigs, the judges all seemed to Jeremiah to be cut from the same bolt of cloth.

To Douglas, who had argued cases in front of them for years, they were individuals. As the judges and the rest of the people in the courtroom sat, he whispered to Jeremiah, "Hardesty there on the left has an open mind; I'm glad to see him, especially with Scott as the other junior judge. As for Kemble in the middle, only he knows what he'll do on any given day. He has a habit of changing his mind from case to case. That's not good in a judge, but it can't be helped."

A second look was plenty to warn Jeremiah to beware of Judge Scott. The man had a long, narrow, unsmiling face, a nose sharp and thin as a swordblade, and eyes like black ice. Even when young, he would not have changed his mind often, and he had not been young for many years.

Hardesty's features were nondescript but rather thoughtful. High Judge Kemble looked like a fox. He had a sly mouth, a sharp nose, and wide blue eyes too innocent to be altogether convincing. Jeremiah would have bet he was rich.

"What case, bailiff?" he asked in a mellifluous tenor.

The bailiff shuffled papers, though both he and the judges knew perfectly well what case it was. He read, "An action brought by Charles Gillen, a citizen of the Commonwealth of Virginia,

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to regain the services of his absconded black slave Jeremiah, the said Jeremiah stating himself to be a freeman and so not liable to provide said services."

Kemble nodded. Hardesty scribbled something, Scott looked bored. The High Judge glanced toward Hayes. "The plaintiff may present his opening remarks."

The lawyer rose, bowed to Kemble and to each of the junior judges in turn. "May it please the honorable judges, we propose to prove that the nigger seated at the defendant's bench is and has been the slave of our client Charles Gillen, that he did willfully run away from the estate of Charles Gillen, and that he has received no manumission or other liberation to entitle him in law to so depart."

"What evidence will you produce to demonstrate this claim, sir?" Kemble intoned.

"I have beside me here the owner of—"

"I protest the word, your excellencies," Douglas broke in. "For all that he borrows books from me, Mr. Hayes is surely too learned to assume what he wishes to prove."

"The *claimed* owner," Hayes amended before the judges could comment. "—the *claimed* owner of this *claimed* slave" (Douglas winced at the sarcasm) "and his son and his overseer, all of whom can identify the individual in question. I shall also produce a bill of sale demonstrating the chattel status of that individual." He sat down, looking as smug as a scrawny man can.

Judge Kemble glanced toward Douglas. "And how does the defendant plan to refute the evidence counsel for the plaintiff shall put forward?"

The lawyer waited for Jeremiah's hesitant nod before he spoke. The magnitude of what they were about to undertake still terrified the black, though they had hashed it out together and agreed it was the best chance to squeeze justice from the court. As Douglas had said, "If you hit something, hit it hard."

For all his brave front, Douglas must have felt a trifle daunted too. His voice was uncharacteristically nervous as he replied, "May it please the honorable judges, we do not seek to refute the plaintiff's evidence. Indeed, we stipulate it as part of the record."

All three judges had to work together to quiet the courtroom. Cries of "Sell-out!" from the few black spectators rose above the buzz of the rest of the audience. The judges stared at Douglas as they wielded their gavels: Hardesty in surprise, Kemble in frank speculation, and Scott resentfully, as if the lawyer had awakened him for no good reason.

Zachary Hayes also spent a few seconds gaping at his colleague. He recovered quickly, though, exclaiming, "If our evidence be admitted, then the case is proven for us. May I ask your excellencies to order the nigger bound over for return to his rightful owner?"

"Bailiff—" Judge Scott began.

Kemble overrode him. "A moment, please. Surely, Mr. Douglas, you could have chosen an easier way to surrender. Why this one?"

"Surrender, your excellency? Who spoke of surrender?" Douglas's voice was at its blandest now, and Hayes's face suddenly clouded with suspicion.

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Douglas went on, "To stipulate that Jeremiah was held in involuntary servitude does our case no harm, as our contention is and shall be that such servitude is not only involuntary but contrary to law."

"On what ground, your excellencies?" Hayes waved the documents he had intended to introduce. "These are all executed according to proper form."

Douglas leaned down to whisper to Jeremiah, "Here we go—no turning back now." The lawyer took a deep breath, faced the judges, and said slowly, "On the grounds that for any man to hold another man in slavery clearly contravenes the Articles of Federation and must therefore have no standing in law anywhere in the Federated Colonies."

The court was silent for a few seconds, while judges, opponents, and audience worked through the legal language to the implications behind it. Hayes furiously shouted, "Your excellencies, I protest!" at the same time as a black man raised a whoop and a white growled, "You hush your mouth there or I'll hush it for you!"

Getting quiet back took longer this time, and the bailiff and court scribe had to eject a couple of particularly obstreperous people. Finally, with some sort of order restored, Judge Scott brought his gavel down and said, "To me, the plaintiff's protest has merit, despite the defense's attempts at obfuscation. This small, open-and-shut case is not one from which to adduce large legal principles."

"Is it not?" Judge Hardesty spoke for the first time. "The principle would appear germane to the issue at hand."

"As Judge Scott has seen, your excellency," Hayes continued his protest to Kemble, "this is but a desperate effort on the part of the defense to shift the case away from the area where they are weakest: the truth. Its merits are clear as they stand; no need to go beyond them."

"On the contrary," Douglas said. "The claim I make is of paramount importance here. If one man may in law own another, when does application of that right end? What would the feelings of the plaintiff and his comrades be, were they at this side of the court, hearing my client lay claim to their services?"

"Any nigger wants me to slave for him'd have to kill me first," Harry Stowe snarled.

Judge Kemble's gavel crashed down, loud as a pistol shot. "Sir, that will be the last such outburst from you. You look to have seen the inside of a courthouse once or twice, enough to have learned the rules of behavior here." The chief judge glowered at Stowe until the overseer dropped his eyes and mumbled agreement. Kemble nodded. "Very well, then; we'll overlook it this time. As for the motion of the defense, however, we rule it is relevant to this case and will hear arguments based thereon." He used the gavel again.

As Hayes rose, he seemed to be fighting to hold his temper. His voice came out steady as he asked for a two-day extension "to study the new situation." Kemble granted it and adjourned the court.

Back in Douglas's office, Jeremiah was jubilant. "That Stowe hurt Mr. Gillen more'n we did!" he grinned. "Without him opening his fool mouth

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that way, the judge wouldn't have got mad and gone along with your motion."

"Associating with me has made you cynical," Douglas said, drawing the cork from a bottle of whiskey and taking a long swig. "Ahh! Better. Actually, I think you're wrong here. Ruling against us, Kemble probably would have lost on appeal, and he's too clever to leave himself open for anything like that. He'll let us hang ourselves instead of doing the work for us."

That assessment shattered the black's cheery mood. "We ain't won yet, then?"

"A skirmish," Douglas shrugged. "You aren't back in the fields, are you? But no, we haven't won. The real fight is just starting."

When Jeremiah's case reconvened, the courtroom was even more packed than it had been before. At the bailiff's command, the people who had managed to gain seats rose to honor the judges. Those at the back—blacks again, mostly—had been standing for some time already, and would keep on until court adjourned.

Judge Kemble rapped for order. Slowly, silence descended. Kemble nodded to Zachary Hayes. "You may begin, sir."

"Thank you, your excellency," Hayes said, rising. "Though I regret the necessity of belaboring the obvious, still it may not be amiss to remind some of the citizens of the Federation of the principles upon which it was built."

He sent a sour glance toward Alfred Douglas before continuing, "I shall not even attempt to cite the precedents sanctioning slavery. Suffice it to say they are both numerous and ancient, dating back on the one hand to the Old Testament, the foundation of our faith; and on the other to the history and institutions of the wise and noble Greeks and Romans, upon whose usages we have modeled our own."

Listening, Jeremiah felt his heart sink. Hayes sounded too knowledgeable, too self-assured. The black's nails bit into his palms. He should have run while he had the chance. All Douglas wanted to do was show off how brilliant he was. Why not?—if he lost the case, it would not hurt *him* any. *He* would not be the one hauled away in chains.

Douglas might have been reading his thoughts. He leaned over and whispered, "Don't give up just yet. He's not saying anything I didn't expect him to."

"All right." But Jeremiah remained unconvinced.

Hayes was saying, "At first glance, it might seem strange that the Federated Commonwealths, whose pride is in upholding the freedom of their citizens, should also countenance slavery. Yet when properly examined, no inconsistency appears. More then two thousand years ago, Aristotle demonstrated in the *Politics* that some men are indeed slaves by nature, and it is only proper for them to serve so that, by enjoying the fruit of their labors, the rest may be truly free.

"How may we judge those who are slaves by nature? Whenever two groups of men differ widely, such that the inferior group can do no more than use their bodies at the direction of their superiors, that group is and ought to be slaves by nature: they reason only enough

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to understand what they are told, not to think new thoughts for themselves.

"Finally, for us a kindly Providence has distinguished this class of individuals by their dusky skins and other features different from our own, to make display of their servile status. This being the case, I trust your excellencies shall soon bring an end to the farce we have seen played out here, and that you shall return this nigger Jeremiah to the station God has intended for him." Conscious of a job well done, Hayes sat.

"Mr. Douglas, you may reply," Judge Kemble said.

"Thank you, your excellency," Douglas said, slowly getting to his feet, "although I naturally hesitate to do so when my learned opponent, as he has demonstrated, is on such intimate terms with the Almighty." Judge Scott's gavel crashed to stifle the small swell of laughter in the court; Hayes gave Douglas a distasteful look.

The younger lawyer brushed a lock of his thick, dark hair back from his forehead. He went on, "I should also like to congratulate Mr. Hayes for the scholarship and energy he has expended to justify the ownership of one man by another. I only find it a pity that he has wasted so much ingenuity over an entirely irrelevant result. 'The mountains labor, and bring forth a ridiculous mouse.' "

This time, all three judges used their gavels, though Jeremiah saw Judge Hardesty's mouth twitch. Hayes sprang out of his chair as if he had sat on a pin. "See here, your excellencies!" he cried. "If this mountebank has a case to make, let him make it, instead of mocking mine."

"The entire proceeding of the defense has skated on thin ice," Judge Scott observed.

"Your excellency, I hope to demonstrate otherwise," Douglas said hastily; not all the sweat that beaded on his face came from Portsmouth's humid heat. "If the court will indulge me, I believe I can do so by summoning two individuals to the witness-box. One is currently in the courtroom; the other, whom I should like to call first, is just outside."

The judges conferred briefly among themselves. "Bunch of damned nonsense!" Jeremiah heard Judge Scott say. He saw the jurist's powdered wig flap indignantly. But after a few minutes, Judge Kemble said, "You may proceed."

"I thank you, your excellency," Douglas said. "I should like the bailiff to fetch in a certain Rob, whom he will find, I expect, sitting against the wall opposite this courtroom."

Bearing a martyred expression—the things half-smart lawyers put him through!—the bailiff went out into the hallway. Jeremiah heard him call, "Rob?" He returned a moment later, his face now frozen. Accompanying him was a male sim, the hair on its head and back and chest grizzled with age.

"Mr. Douglas, I do not know what you are playing at, but I assure you I am no longer amused," Judge Kemble snapped. "You know perfectly well that no testimony by a sim is valid in a court of law, they being incompetent to understand or take an oath."

"Yes, your excellency, I am aware of that," Douglas answered. "It was for that very reason that I summoned

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Rob—who belongs to a friend of mine—before you. The presence of sims on these shores, you see, has a vital impact on the question of slavery."

"Why? Are you planning to liberate them next?" Judge Scott asked.

Such sarcasm from the bench was dangerous. "No, your excellency," Douglas replied at once. "I believe it just they serve mankind. But their just service points out the injustice of forcing men to similar servitude."

"I fail to see how," Scott grumbled.

"Then let him show us, if he can," Judge Hardesty suggested softly. His partner's face did not clear, but Scott kept to himself the protests he still plainly felt. After glancing at Judge Kemble, Hardesty said to Douglas, "You may proceed."

"Thank you, your excellency." Douglas pointed toward Rob, who sat calmly in the witness-box, looking rather bored and working his massive jaws to help pass the time. "Here we have a being gifted with intelligence—"

"Not much!" someone called from the audience, which raised a laugh and made the judges pound loudly for order. Jeremiah spent the next several minutes looking down at the table in front of him, until he trusted his control over his features once more. Douglas, he knew, had paid the fellow three denaires for that interruption.

The lawyer's face revealed nothing of his machinations. "—gifted with intelligence," he repeated, "though of a lesser sort than our own. Its existence is not to be denied; in the wild, sims craft crude tools of stone, and attempt to imitate ours, in a fashion no brute beast could match.

"But as most of you know, they have no language of their own, and most fail to master the English tongue. Can you speak, Rob?" Douglas asked, turning to the sim.

Its previously placid face grew tense as it struggled against its own slow wits and balky muscles. "Y-y-y-yess," it got out at last, and sat back, proud and relieved. *Speak good,* it added with signs.

"So you do," Douglas acknowledged. He concentrated on the judges again. "Had I bid the sim read to us from the simplest children's primer, of course, it would have been helpless, as it would have been to write its name. No man has yet succeeded in teaching sims their letters."

"And no man yet has taught a turtle to waltz," Zachary Hayes broke in. "What of it? The issue here is niggers, not sims. Perhaps my distinguished opponent needs reminding of it."

"Yes, Mr. Douglas, we have been patient for some time now," Judge Kemble said. "We shall not be pleased if this course of yours leads nowhere."

"It leads to the very heart of the issue, your excellency," Douglas assured him. "For consider: in the slavery of the ancients, what was their chiefest concern? Why, just as the learned Mr. Hayes has demonstrated—to define who might rightfully be a slave, and who was properly free. The great Aristotle developed the concept my opponent discussed so well, that of the slave by nature. Here, in the person of Rob and in his kind, we see exactly what the Greek sage intended: a being with a body strong enough for the tasks we set, yet without wit enough to set against our will.

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"Aristotle admitted that in his day, the most difficult thing to determine was the quality of mind that defined the natural slave. And no wonder, for he was trying to distinguish among groups of men, and all men are far more like each other than they differ from sims. In these modern times, we have a true standard of comparison.

"Mr. Hayes put forth the proposition that the physical appearance of niggers brands them as slaves. That is the same as saying painted plaster will satisfy the stomach because it looks so good. In this court, should we not examine essence rather than exterior? To do so, I should like to summon my client Jeremiah to the witness-box."

While Douglas was signing to Rob that it could go, Hayes sprang up, exclaiming, "I protest this—this charade!"

"On what grounds, sir?" Judge Kemble said.

"On the grounds that it is obviously a trick, rehearsed well in advance, intended to make this nigger out to be Aristotle, Charlemagne, and the Twelve Apostles all rolled into one!"

"Aye, there's a stink of collusion in the air," Judge Scott rumbled.

"How say you, Mr. Douglas?" Kemble asked.

Douglas's smile was beatific, the smile of a man whose enemy has delivered himself into his hands. "Your excellency, I say that even if I were to admit the charge—and I do not; I deny it—it would only help my own case. How could I conspire with Jeremiah unless he had the brains to plot along with me?"

Hayes opened his mouth, closed it again. His eyes were wide and staring. Judge Hardesty let out a most unjudicial snort, then tried to pretend he hadn't. Judge Scott looked grim, which meant his expression changed not at all. Stifled whoops and cheers came from the blacks at the back of the courtroom. Judge Kemble gaveled them down.

"You may proceed, sir," was all he said to Douglas. The lawyer dipped his head, waved Jeremiah forward to take the oath. As Jeremiah raised his hand, he thought Douglas would remind the judges that he, unlike a sim, was able to do so. But Douglas knew when to be subtle. The fact itself spoke louder than anything he could say about it.

Facing the courtroom was harder than Jeremiah had expected. Except for those of the few blacks, he was hard-pressed to find a friendly face. The white men in the audience regarded him with looks ranging from stony disapproval to out-and-out hatred. Harry Stowe was part of the latter group.

Next to him sat the two people Jeremiah knew best here, Charles and Caleb Gillen. The habits of years died hard; it hurt Jeremiah to see the contempt on the face of the man who had owned him, and to see his master's son scowling at him as at Iscariot. He started to smile, then let his face freeze. They would re-enslave him without a qualm if the judges said they could. That made them no friends of his.

Douglas produced a small, thick book and presented it to Zachary Hayes, "Would you care to open the Bible at random, sir, so Jeremiah may read the passage you select?"

The old lawyer drew back from the book as if it had come from the devil.

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"You'll not make me part of your trickery, sir! Like as not, you've had him memorize Scripture for the sake of looking good here."

"Again you prove what you'd sooner oppose," Douglas said. "If Jeremiah were stupid as a sim, he wouldn't be able to memorize the Good Book. You'll make a man of him in spite of yourself."

He turned to the bench. "Would one of you care to make the selection, your excellencies? I don't want any possibility of deceit in this, for such as Mr. Hayes to tax me with."

To Jeremiah's surprise, Judge Scott took the Bible from Douglas. The lawyer's face fell when he saw that Scott did not open the book anywhere, as he had suggested, but went hunting for a specific passage. "Here," the judge said. "Let him read *this*." He stabbed at the section he wanted with his thumb, adding for the record, "This is the seventh chapter of First Chronicles."

Jeremiah certainly had not memorized it; he had no idea what was in the passage. But when Douglas handed him the Bible, he understood why the lawyer had gone expressionless. The chapter was one of those collections of begats that crop up every now and then, and one full of names more obscure than most.

Having no choice, he gulped and plunged in: " 'And of the sons of Issachar, Tola, and Puah, Jashub, and Shimron, four. And the sons of Tola: Uzzi, and Rephaiah, and Jeriel, and Jahmai, and Ibsam, and Shemuel . . .' " He read slowly and carefully, often pausing to sound out an unfamiliar name. He knew he sometimes stumbled, and hated himself for it, but Judge Scott had set too wicked a trap for him to escape unscathed.

He fought his way through the sons of Bilhan (Jeush, Benjamin, Ehud, Chenanah, Zethan, Tarshish, and Ahishahar), the sons of Shemida (Ahian, Shechem, Likhi, and Aniam), and the sons of Asher (Imnah, Ishvah, Ishvi, and Beriah, to say nothing of their sister Sarah). He almost broke down on Pasach, Bimhal, and Asvath (the sons of Japhlet). But his voice rose in triumph as he came at last to the sons of Ulla—Arah, and Hanniel, and Rizia.

" 'All these,' " he finished, " 'were the children of Asher, heads of the fathers' houses, choice and mighty men of valor, chiefs of princes. And the number of them reckoned by genealogy for service in war was twenty and six thousand men.' "

He closed the Bible. The courtroom was very quiet. Douglas walked up and took the book from him. Judge Scott looked down at his hands, up to the plaster of the ceiling, anywhere but at Jeremiah.

"I think you can go back to our table now, Jeremiah," Douglas murmured.

Jeremiah's feet hardly seemed to touch the ground as he returned to his place. He heard Caleb Gillen whisper to his father, "I'm so sorry, sir. It's my fault he can read at all. I went and put ideas in his head, and see the thanks we get."

There was enough truth in that to sting, a little. Yes, Caleb had taught Jeremiah to read, but he was forgetting, in the way that was so easy for someone used to thinking of people as belongings, that Jeremiah had wanted to be

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free long before he could pick out the word "liberty" on the printed page. Caleb had been willing enough to help back last summer, when Jeremiah's goal seemed indefinitely far away. Now that it was here, Caleb was finding he did not like it so well.

"Mr. Hayes?" Judge Kemble said, and then again, more sharply, "Mr. Hayes?"

Jeremiah had thought Hayes would have to give in—despite having worked so long for Douglas, he was still naive about lawyers. Hayes slowly rose, long and angular. He made a production out of stretching.

"Begging your excellency's pardon," he said, perfectly self-possessed. "I was woolgathering there. In considering this case, you must remember that it bears on, not a single individual but, by the census of '98, on close to a million persons of African descent. What of their masters' property rights? Further, assuming that by some mischance they should become free, how are they to provide for themselves? And how will they take their place in a society of free men? Freedom bestowed as a gift will mean nothing to them, as they will have done nothing to earn it."

Judge Hardesty nodded thoughtfully. That frightened Jeremiah, who had come to think of the quiet judge as being on his side. "What are we going to do?" he asked harshly.

Douglas might as well not have heard him. He waited till he was sure Hayes had finished, then heaved his bulk upright. "When a man shifts his argument from principle to expediency," he remarked, "trust neither. My learned opponent is looking to sow panic where none need exist; he speaks as if we were on the point of civil war. Why do we have courts, if not to treat our abuses before we need the medicine that soldiers give?"

"Very pretty," Hayes said. "You answer none of the points I raised, but very pretty nonetheless."

"Had you not interrupted me, I would have answered," Douglas replied sweetly. "I don't presume to make the law, but I can offer some suggestions. You quoted the ancients when it suited your purpose. They had their ways of dealing with freedmen, and of easing them into the life of the state. Perhaps some of the first generation would remain as clients to their one-time masters, working for a wage for some length of time before severing all obligations. Given a few years and goodwill, the thing can be done painlessly."

Hearing Douglas propose curtailing his freedom made Jeremiah scowl. He hated the thought of going back to work for the Gillens, even as a free man. But a moment's reflection reminded him that before he had been willing enough to stay on as a slave, so long as he was treated well and had some hope of buying his liberty one day. He had run away from maltreatment, not slavery.

And, he realized, other blacks would not face the problem of ex-owners with grudges as deep-seated as the Gillens' against him. Or would they . . . ?

Zachary Hayes might have picked the thought from his brain. "Painlessly, eh?" he sneered, turning Douglas's word against him. "You can make all the laws you like, sir, but how do you propose making the good white men who built the Federated Commonwealth

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accept their niggers as their equals?'' There was the heart of things, dragged out naked and bleeding.

Before Douglas could get up to respond Jeremiah found himself on his feet. ''Your excellencies, can I say something?''

Judge Kemble glanced toward Douglas, who looked startled but shrugged. ''Is it germane?'' the judge asked sternly.

''Sir?''

''Does it apply? Has it a bearing on the case here?''

''Oh. Yes, sir, that it does. Indeed it does.''

''Very well. Be brief.''

''Thank you, sir.'' Jeremiah took a deep breath. ''Seems to me, sir, a lot of white folks needs to look down at niggers on account of they need to feel they're better'n somebody. But even if you did free every nigger tomorrow, made 'em just the same as whites to the law, those would still know they were higher on the scheme of things than sims.

''Your excellencies, one of the things helped me get by so long as a slave was knowing the sims were there below me. Truth to tell,'' he went on, drawing on his thoughts of a few minutes before, ''I didn't leave the Gillen farm till they stopped treating me like I was a man and worked me like a sim in the fields. That's purely not right, sirs, making a man into a sim, and if slavery lets one man do that to another, why it's not right either. That's all.''

He sat as abruptly as he had risen. Douglas leaned over and patted him on the back, murmuring, ''Out to steal my job? You just might do it.''

''Huh,'' Jeremiah said, but the praise warmed him.

The arguments went on; Hayes was not one to leave a case so long as he had breath to talk. But he and Douglas were hammering away at smaller points now, thrashing round the edges of things. Douglas only got in one shot he thought telling, a reminder of the historic nature of the case.

''That's for Kemble's sake,'' he told Jeremiah during a recess. ''Letting him think people will remember his name for ever for the sake of what he does here can't hurt.''

Jeremiah thought about that, and contrasted it to Caleb Gillen's picture of the law as a vast impersonal force poised over the head of miscreants. He preferred Douglas's way of looking at things. People were easier to deal with than vast impersonal forces.

Jeremiah Gillen walked down Granby Pike toward the Benjamin and Levi Bank of Portsmouth. Money jingled in his pocket. Even if the Conscript Fathers of Virginia decided to set up a clientage system like the one Alfred Douglas had outlined the year before, by now he had enough money to buy himself out of any further service to the family that had once owned him.

Hayes was still appealing his case, of course sending up writ after writ based on Judge Scott's narrow interpretation of the law. But Judge Hardesty had been as narrowly for Jeremiah as Scott was against him, and Judge Kemble's ringing condemnation would be hard to overturn. Douglas had been dead right about him, Jeremiah thought—he

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must have decided the eyes of history were on him.

A sim struggling along with a very fat knapsack bumped into Jeremiah. "Watch where you're going, you brainless flathead," he snapped.

The sim cringed. It managed to get one hand free of its burden for a moment to sign, *Sorry. Then it staggered on.*

Jeremiah felt briefly ashamed. After all, were it not for sims, blacks would have been at the bottom of things, the target of everyone's spleen.

He almost went after the subhuman to apologize, but the sim would never have understood. And that was exactly the point.

He kept on toward the bank. ■

ON GAMING

(continued from page 73)

navies, and build new forces and weapons. The last activity possible is buying resources, at the current market price.

Movement of armies is a simple process of paying one unit of grain for every territory moved through, or two units of oil for an airlift to any territory on the board. Navies, which can carry up to four armies, pay one oil unit for every sea zone they pass through.

In combat, the attacker gets one die versus the defender's two, with the larger force getting an extra die. Then each player rolls, removing one opposing force for every three points rolled on their die.

There are so many entertaining touches in this game it's hard to know where to begin. You prospect, for example, by flipping through the resource deck—at 200 million per flip, mind you—to find your desired commodity. If it's nuclear capability that you're looking for, it may take a while. And the deck is reshuffled after each turn.

Nukes—which cost five hundred million dollars and one mineral unit—totally devastate an area, naturally, but can be brought to bay by a satellite defense system, an L-Star. Any attack, conventional or nuclear, gives the defender the right to counterattack, and both forces can, up to their supply limit, move reinforcements into the battle. Believe me, things can get pretty wild as small battles just seem to grow.

Of course, there can be that somewhat solemn moment. It happened rather suddenly in the last game I played. I was attacked conventionally, almost wiped out, and then it was time for my counterattack. Well, I had built up a force of eight nukes and I retaliated with a strategic attack. Since my opponent had no L-Stars, her home territory was completely devastated. Game over, and, since she was having a ball playing, she was more than a bit chagrined at the "sudden death."

But the game wasn't over. In fact, until she reads this she won't know that it was a draw. You see, as defender her forces can still counterattack. And she had just enough nukes to eliminate my home territories.

A draw then, with mushroom clouds all over the place.

A bit grim? Well, *Trivial Pursuit* it's not. But if you and some friends play in the spirit of Stanley Kubrick's *Dr. Strangelove, or How I Learned To Stop Worrying and Love the Bomb,* you'll have one hell of a night of gaming. ■

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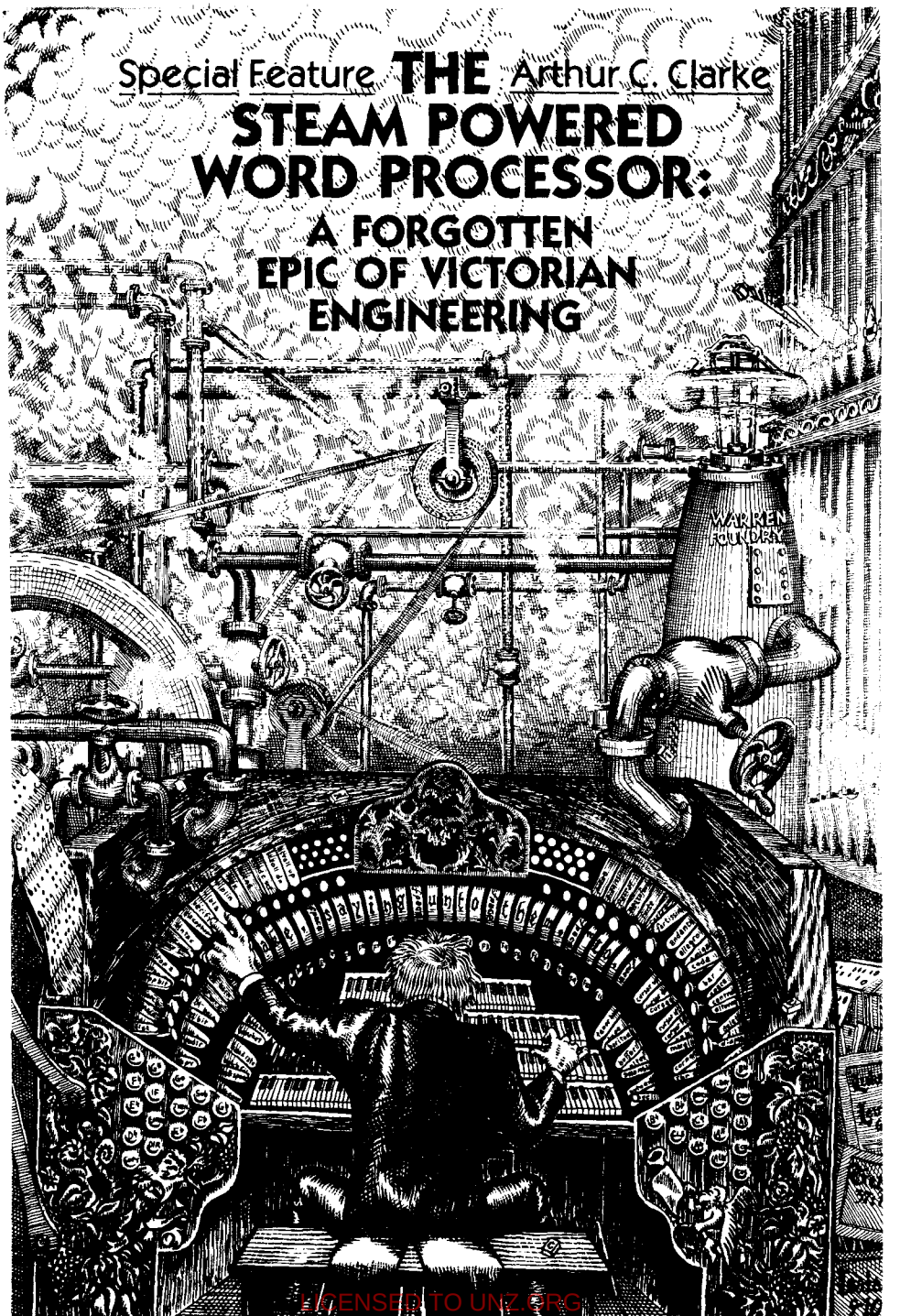
Special Feature

THE STEAM POWERED WORD PROCESSOR: A FORGOTTEN EPIC OF VICTORIAN ENGINEERING

Arthur C. Clarke



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Foreword

Very little biographical material exists relating to the remarkable career of the now almost forgotten engineering genius, the Reverend Charles Cabbage (1815–188?), one-time vicar of St. Simians in the Parish of Far Tottering, Sussex. After several years of exhaustive research, however, I have discovered some new facts which, it seems to me, should be brought to a wider public.

I would like to express my thanks to Miss Drusilla Wollstonecraft Cabbage and the good ladies of the Far Tottering Historical Society, whose urgent wishes to disassociate themselves from many of my conclusions I fully understand.

As early as 1715 *The Spectator* refers to the Cabbage (or Cubage) family as a cadet branch of the de Coverleys (bar sinister, regrettably, though Sir Roger himself is not implicated). They quickly acquired great wealth, like many members of the British aristocracy, by judicious investment in the Slave Trade. By 1800 the Cabbages were the richest family in Sussex (some said in England), but as Charles was the youngest of eleven children he was forced to enter the Church and appeared unlikely to inherit much of the Cabbage wealth.

Before his thirtieth year, however, the incumbent of Far Tottering experienced a remarkable change of fortune, owing to the untimely demise of all his ten siblings in a series of tragic accidents. This turn of events, which contemporary writers were fond of calling "The Curse of the Cabbages," was closely connected with the vicar's unique collection of medieval weapons, oriental poisons, and venomous reptiles. Naturally, these unfortunate mishaps gave rise to much malicious gossip, and may be the reason why the Reverend Cabbage preferred to retain the protection of Holy Orders, at least until his abrupt departure from England.[1]

It may well be asked why a man of great wealth and minimal public duties should devote the most productive years of his life to building a machine of incredible complexity, whose purpose and operations only he could understand. Fortunately, the recent discovery of the Faraday-Cabbage correspondence in the archives of the Royal Institution now throws some light on this matter. Reading between the lines, it appears that the reverend gentleman resented the weekly chore of producing a two-hour sermon on basically the same themes, one hundred and four times a year. (He was also incumbent of Tottering-in-the-Marsh, pop 73.) In a moment of inspiration which must have occurred around 1851—possibly after a visit to the Great Exhibition, that marvellous showpiece of confident Victorian know-how—he conceived a machine which would *automatically* reassemble masses of text in any desired order. Thus he could create any number of sermons from the same basic material.

This crude initial concept was later greatly refined. Although—as we shall see—the Reverend Cabbage was never able to complete the final version of his "Word Loom," he clearly envisaged a machine which would operate not only

[1]Ealing Studios deny the very plausible rumour that Alec Guiness' "Kind Hearts and Coronets" was inspired by these events. It is known, however, that at one time Peter Cushing was being considered for the role of the Reverend Cabbage.

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upon individual paragraphs but single lines of text. (The next stage—words and letters—he never attempted, though he mentions the possibility in his correspondence with Faraday, and recognized it as an ultimate objective.)

Once he had conceived the Word Loom, the inventive cleric immediately set out to build it. His unusual (some would say deplorable) mechanical ability had already been amply demonstrated through the ingenious man-traps which protected his vast estates, and which had eliminated at least two other claimants to the family fortune.

At this point, the Reverend Cabbage made a mistake which may well have changed the course of technology—if not history. With the advantage of hindsight, it now seems obvious to us that his problems could only have been solved by the use of electricity. The Wheatstone telegraph had already been operating for years, and he was in correspondence with the genius who had discovered the basic laws of electromagnetism. How strange that he ignored the answer that was staring him in the face!

We must remember, however, that the gentle Faraday was now entering the decade of senility preceding his death in 1867. Much of the surviving correspondence concerns his eccentric faith (the now extinct religion of "Sandemanism") with which Cabbage could have had little patience.

Moreover, the vicar was in daily (or at least weekly) contact with a very advanced technology with over a thousand years of development behind it. The Far Tottering church was blessed with an excellent 21-stop organ manufactured by the same Henry Willis whose 1875 masterpiece at North London's Alexandra Palace was proclaimed by Marcel Dupre as the finest concert-organ in Europe.[2] Cabbage was himself no mean performer on this instrument, and had a complete understanding of its intricate mechanism. He was convinced that an assembly of pneumatic tubes, valves, and pumps could control all the operations of his projected Word Loom.

It was an understandable but fatal mistake. Cabbage had overlooked the fact that the sluggish velocity of sound—a miserable 330 meters a second—would reduce the machine's operating speed to a completely impracticable level. At best, the final version might have attained an information-handling rate of 0.1 Baud—so that the preparation of a single sermon would have required about ten weeks!

It was some years before the Reverend Cabbage realized this fundamental limitation; at first he believed that by merely increasing the available power he could speed up his machine indefinitely. The final version absorbed the entire output of a large steam-driven threshing machine—the clumsy ancestor of today's farm tractors and combine harvesters.

At this point, it may be as well to summarize what little is known about the actual mechanics of the Word Loom. For this, we must rely on garbled accounts in the *Far Tottering Gazette* (no

[2]Since the 1970s my indefatigable brother Fred Clarke, with the help of such distinguished musicians as Sir Yehudi Menuhin (who has already conducted three performances of Handel's *Messiah* for this purpose) has spearheaded a campaign for the restoration of this magnificent instrument.

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complete runs of which exist for the essential years 1860-80) and occasional notes and sketches in the Reverend Cabbage's surviving correspondence. Ironically, considerable portions of the final machine were in existence as late as 1942. They were destroyed when one of the Luftwaffe's stray incendiary bombs reduced the ancestral home of Tottering Towers to a pile of ashes.[3]

The machine's "memory" was based—indeed, there was no practical alternative at the time—on the punched cards of a modified Jacquard Loom; Cabbage was fond of saying that he would weave thoughts as Jacquard wove tapestries. Each line of output consisted of 20 (later 30) characters, displayed to the operator by letter wheels rotating behind small windows.

The principles of the machine's COS (Card Operating System) have not come down to us, and it appears—not surprisingly—that Cabbage's greatest problem involved the location, removal, and updating of the individual cards. Once text had been finalized, it was cast in type-metal; the amazing clergyman had built a primitive Linotype at least a decade before Mergenthaler's 1886 patent!

Before the machine could be used, Cabbage was faced with the laborious task of punching not only the Bible but the whole of Cruden's Concordance on to Jacquard cards. He arranged for this to be done, at negligible expense, by the aged ladies of the Far Tottering Home for Relicts of Decayed Gentlefolk—now the local Disco and Breakdancing Club. This was another astonishing First, anticipating by a dozen years Hollerith's famed mechanization of the 1890 US Census.

But at this point, disaster struck. Hearing, yet again, strange rumors from the Parish of Far Tottering, no less a personage than the Archbishop of Canterbury descended upon the now obsessed vicar. Understandably appalled by discovering that the church organ had been unable to perform its original function for at least five years, Cantuar issued an ultimatum. Either the Word Loom must go—or the Reverend Cabbage must resign. (Preferably both: there were also hints of exorcism and re-consecration.)

This dilemma seems to have produced an emotional crisis in the already unbalanced clergyman. He attempted one final test of his enormous and unwieldy machine, which now occupied the entire western transcept of St. Simians. Over the protests of the local farmers (for it was now harvest time) the huge steam engine, its brassware gleaming, was trundled up to the church, and the belt-drive connected (the stained-glass windows having long ago been removed to make this possible.)

The reverend took his seat at the now unrecognizable console (I cannot forbear wondering if he booted the system with a foot pedal) and started to type. The letterwheels rotated before his eyes as the sentences were slowly spelled

[3]A small portion—two or three gearwheels and what appears to be a pneumatic valve—are still in the possession of the local Historical Society. These pathetic relics reminded me irresistably of another great technological might-have-been, the famous Anticythera Computer (see Derek de Solla Price, *Scientific American*, July 1959) which I last saw in 1965, ignominiously relegated to a cigar box in the basement of the Athens Museum. My suggestion that it was the Museum's most important exhibit was not well received.

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out, one line at a time. In the vestry, the crucibles of molten lead awaited the commands that would be laboriously brought to them on puffs of air. . . .

Faster, faster! called the impatient vicar, as the workmen shoveled coal into the smoke-belching monster in the churchyard. The long belt, snaking through the narrow window, flapped furiously up and down, pumping horsepower upon horsepower into the straining mechanism of the Loom.

The result was inevitable. Somewhere, in the depths of the immense apparatus, something broke. Within seconds, the ill-fated machine tore itself into fragments. The vicar, according to eyewitnesses, was very lucky to escape with his life.

The next development was both abrupt and totally unexpected. Abandoning Church, wife, and thirteen children, the Reverend Cabbage eloped to Australia with his chief assistant, the village blacksmith.

To the class-conscious Victorians, such an association with a mere workman was beyond excuse (even an underfootman would have been more acceptable!)[4] The very name of Charles Cabbage was banished from polite society, and his ultimate fate is unknown, though there are reports that he later became chaplain of Botany Bay. The legend that he died in the Outback when a sheep-shearing machine he had invented ran amok is surely apocryphal.

Afterword

The Rare Book section of the British Museum possesses the only known copy of the Reverend Cabbage's *Sermons in Steam*, long claimed by the family to have been manufactured by the Word Loom. Unfortunately, even a casual inspection reveals that this is not the case; with the exception of the last page (223-4), the volume was clearly printed on a normal flat-bed press.

Page 223-4, however, is an obvious insert. The impression is very uneven, and the text is replete with spelling mistakes and typographical errors.

Is this indeed the only surviving production of perhaps the most remarkable—and misguided—technological effort of the Victorian Age? Or is it a deliberate fake, created to give the impression that the Word Loom actually operated at least once—however poorly?

We shall never know the truth, but as an Englishman I am proud of the fact that one of today's most important inventions was first conceived in the British Isles. Had matters turned out slightly differently, Charles Cabbage might now have been as famous as James Watt, George Stevenson—or even Isambard Kingdom Brunel. ■

[4]How D.H. Lawrence ever heard of this affair is still a mystery. As is now well known, he had originally planned to make the protagonist of his most famous novel not Lady Chatterley, but her husband; however, discretion prevailed, and the Cabbage Connection was revealed only when Lawrence foolishly mentioned it, in confidence, to Frank Harris, who promptly published it in the *Saturday Review*. Lawrence never spoke to Harris again; but then, no one ever did.

● As I grow older I pay less attention to what men say. I just watch what they do.

Andrew Carnegie

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the reference library

By Tom Easton

The John W. Campbell Letters, Perry A. Chapdelaine, Sr., Tony Chapdelaine, and George Hay, eds., AC Projects, Inc. (Authors' Co-op, Inc., Rt. 4, Box 137, Franklin, TN 37064, (615) 646-3757), $5.95, 610 pp.
The Fallen Country, Somtow Sucharitkul, Bantam, $2.95, 208 pp.
The Cross-Time Engineer, Leo A. Frankowski, Ballantine/Del Rey, $2.95, 272 pp.
The Odysseus Solution, Michael Banks and Dean R. Lambe, Baen Books, $2.95, 279 pp.
Dad's Nuke, Marc Laidlaw, Donald I. Fine, Inc., $15.95, 255 pp.
Starhammer, Christopher Rowley, Ballantine/Del Rey, $2.95, 304 pp.
Yonder Comes the Other End of Time, Suzette Haden Elgin, DAW, $2.95, 302 pp.
Memory Bank, John E. Stith, Ace, $2.95, 230 pp.
Visible Light, C.J. Cherryh, Phantasia (5536 Crispin Way, West Bloomfield, MI 48033), $17.00 (trade ed.), $40.00 (300 copies; signed, numbered, & boxed), ? pp.; DAW, $?, ? pp.

I am writing this on January 28, and it has been quite a day. When I woke up, the radio was saying that L. Ron Hubbard, aged 74, had died the previous Friday. As you know, I don't think much of what he's been writing lately, but that is beside the point. He was an important part of the Golden Age of SF, and his passing marks one more sign that that Age is gone.

Later today, as I emerged from my classroom at Thomas College, I learned that the Space Shuttle *Challenger*, carrying six astronauts and teacher Christa McAuliffe, had blown up 72 seconds after launch. I am numb with shock, and apprehensive about what this tragedy may do to the space program. Only if our leaders grow more angry than fearful will it help; with anger, they may resolve to prevent a repetition of the accident by spending money and effort to do manned launches *right*. If they are

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more fearful, the program will be paralyzed for years to come.

Any bets? Accidents happen, but some politicians are already screaming that the Space Shuttle is a killer boondoggle, and that the billion dollars or so that went into that Florida explosion could have done much more good in social programs. They ignore the evidence—federal money spent in ways that produce jobs does more good for society as a whole than food stamps, AFDC, etc. (might we then say the Challenger explosion is a social good? After all, we'll have to build a replacement—won't we?—and that will mean jobs)—but that's par for the course.

I add these lines a few days later: I see the anti-space noise is picking up volume. But there is also a great tide of sympathy and of something that might soon become resolve. I see both in the letters to the editor in my local paper, and I dare to hope that by the time you read this column, the resolve will have become national, will have firmed, and will have put new life into the manned space program. I think of the newer Shuttle designs that need only decision and money, of moonbases and asteroid mines and O'Neill colonies and powersats, and all the rest. Those who died with the *Challenger* are heroes, and it seems to be a human tendency to attack, to conquer, not to flee, whatever kills our heroes. Maybe, just maybe, the readers of this magazine, will have their faith in the attainability of space fulfilled.

If the *Challenger* tragedy fills us with a firmer determination to make those things real . . . It will still be a tragedy. It will still be nothing anyone in his or her right mind, not even the most gung-ho of space fans, would deliberately choose. But it will have redeemed itself, much as the wild rose redeems the gravestone. We may even, one day, say it was all for the best.

Getting back to SF, we see another sign of the Golden Age's passing in a memorial to the time, the first of several reasonably priced (less than a penny a page), massive, paperback monuments to the man who, more than any other, made that Age what it was. It's *The John W. Campbell Letters*, and it will let you answer for yourself those burning questions: Was the man who edited *Astounding/Analog* for 33 years and two months really as argumentative as rumor has it? Was he as batty? Was he really the Great Man who reshaped science fiction in his own image?

You will find that the answers are all "Yes." By all accounts, even his own, the man never stopped talking, never ceased to play with ideas, new and old, never let up his blitzkrieg attack on the beliefs and opinions of those around him. Weak personalities foundered in his wake; the strong staggered off with their heads buzzing. Happily, the latter were his favorites, and the buzzes he gave them turned into new SF stories, and new kinds of SF stories. The stories were usually their own, for Campbell insisted that they not write *his* stories but use his provocations, his questions, even his plot sketches, as take-off points. More than one tale appeared when he said to a writer, "Bet you can't . . ." He was an active, kibbitzing editor, and the method worked.

Campbell loved to argue for the sake of argument. It showed in his provocative editorials, a tradition which Stan Schmidt continues in his mild-mannered way. It showed too in his letters, for he rehearsed there the notions that eventually appeared in print; some of them he rehearsed for years, bouncing them off his writers and his academic con-

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tacts, countering their objections, incorporating their additions.

Was he really batty? He himself claimed to be an amateur, a dilettante, who flitted from Dianetics to Dean drives to . . . you name it. An iconoclast, his letters clearly show him to be less critical of offbeat ideas than he might have been. He was so open-minded that some might easily say he was a credulous fool; certainly, there was no profession on Earth he would have fitted better than that of SF editor and writer.

It all shows in the book. Unfortunately, the book *is* massive, and its nature makes it an extremely tedious, repetitive read. Campbell wrote, say the editors, tens of thousands of letters, most of them several single-spaced pages long. They apparently plan to publish them all, too—or all they can get their hands on—even though a much clearer view of Campbell would emerge from a more selective, organized approach, perhaps a biography illustrated with a few letters, or with brief quotations from the letters. It's all there in the letters and in the handful of worshipful essays flanking them, but a more focused approach would be briefer, more readable, and more valuable.

The great defect of the book is that it is an act of worship, not of scholarship. It suffers from its lacks of objectivity and of interpretation. Nevertheless, it *does* give us a long-awaited portrait of a seminal figure in our field. Buy it. Dip into it, learning what Campbell once had to say to and about Herbert, Hubbard, Budrys, Schmidt, Asimov, and many more. But watch out, or the missionaries will get you!

A word of warning: The best novel I've read this month is Somtow Sucharitkul's **The Fallen Country**, but it is not much like what you might expect from Somtow. There are no vampires, interstellar empires, or marvelous technologies. Of his usual, there remains only his patent grand opera approach to drama.

The Fallen Country is Somtow's first for young adults, though we are told as much only in the last-page bit about the author. And it should appeal to them admirably, while offering plenty for older readers. The theme is child abuse, with Billy Binder the quintessential victim. He is a foster child, tossed from home to home until he winds up in Florida, where "Mommy" takes up with Stark, a pusher and ex-lion tamer who insists that Billy love him, and will beat him until he does. Billy's answer is the Fallen Country, a land of ice and snow where all feelings except anger are numbed, and anger becomes a shield and a weapon.

Yet the book is only partly about Billy and his problems and solutions. It is more about—and for—Billy's peers at school, who see a helpless, hopeless nerd and include him out. However, led by Charley, a teen on the agonizing verge of adulthood, they begin to recognize that Billy is as human as they. They begin to empathize. And, once it is clear that the Fallen Country is real—Billy vanishes physically into it, returning cold, frozen, covered in ice, bedded in snow, and he can take others there with him—they join him on his Quest to defeat the Ringmaster, of whom Stark is a pale shadow, and reawaken his human feelings.

There is a moving plea here for not rejecting the unfortunate out of hand. There is another for the value of empathy. Both can profitably be taken to heart not just by young adults, but also by old ones.

* * *

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A Connecticut Yankee in King Arthur's Court was pretty good when Mark Twain thunk it up, you know? Here was this nice, all-American engineer who got flipped back in time, palled it up with the Round Table, and tried to get an Industrial Revolution going a few years ahead of schedule. A couple of girls were involved, too, as I recall.

It's still a pretty good tale, even when Leo Frankowski calls his version **The Cross-Time Engineer** and makes his hero a Polish engineer, just to counteract all those Polish jokes. The girls are still there, though a little more in the flesh. The incipient Industrial Revolution is there, though it looks to be more successful, since the hero has the added motivation of wanting to save his land from the Mongol invasion ten years hence. So is the time travel, though it owes little to a knock on the head. So, for that matter, is knighthood, though 13th century Polish knights seem to have lacked the high ideals of their Arthurian colleagues.

Frankowski fails to match Twain for two reasons. First, Twain did his job in one volume. Frankowski plans four, with the first chopping the tale off very much in the middle of things—no resolution, no cliff-hanger, just "Enough for today." Bah!

Second, Twain did it first. Frankowski can write clearly and sometimes evocatively. His characters are cardboard, but they fit what is essentially a light entertainment; they're fun. His action moves right along. But it is all wasted as long as he chooses to tell someone else's story.

In **The Odysseus Solution**, Michael Banks and Dean Lambe have a nice twist on the old theme of alien invasion. The bird-like Cweom-jik have arrived in Earth's solar system seeking a new world for colonization. Unfortunately, Earth is occupied. Fortunately, the Cweom-jik have nasty minds. They surreptitiously introduce matter duplicators to Earth. Once the devices have thoroughly shattered the economy, they reveal themselves as saviors. Within a few years, they have their talons firmly on humanity's collective neck. They blast cities to destroy all traces of past technical knowledge, they destroy all signs of present technology beyond the little they allow the human villages, and they hunt down rebellious humans. They are, of course, aided by human quislings.

A generation later, there seems little hope, though there are rumors of an Underground. When Brent Erlanger has to leave town in a hurry because of an illicit dalliance with the mayor's daughter, he dreams of finding the rebels. With a little luck, he succeeds, finding an Underground that is literally under ground. Its people are descended from the personnel of a long-ago Defense Department research station in Oak Ridge, buried under the local hills. They have a lot of the old technology and knowledge, they are busily rebuilding more from what they can find in the ruins around them, and they are seeking answers to Cweom-jik technology. Brent's arrival introduces him to education, true love, and a sense of mission. He plays a key role in the recovery and use of essential knowledge from the ruins of Cincinnati. If he does not help throw the Cweom-jik off the planet, that is only because the book does not go that far. Banks and Lambe are content to take their story only to the point where, at long last, that seems possible.

The book is a good, fast read in the fine old tradition of *Astounding/Analog* with rather fewer implausibilities than we often see. There are no supermen

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here and no phenomenally lucky underdogs. The Underground works hard for its gains, and those gains are nearly as incremental as in real life. On the other hand, the Cweom-jik and their quislings do seem a mite stupid; I think present human technology is up to the task of locating a large underground base rather more effectively than the supposedly more advanced Cweom-jik manage. As a human chauvinist, I can accept that, and I expect that you can too.

Marc Laidlaw's first novel, **Dad's Nuke**, is a curiosity. In an America given over to religious armies *à la* Beirut, rabid anarchists, and other clues to ultimate social breakdown, there is a residential enclave. Located on the California coast, it is isolated by its own Iron Curtain, an armed barrier that keeps the residents in as thoroughly as it keeps intruders out. Within the wall lies the ultimate suburbia. Daddy is a teleworker, plugging into his computer to labor, via sophisticated waldoes, at mysterious tasks. Mommy keeps the home. The kids, carefully designed —genetic engineering, don't you know?—to round out the family unit with smarts, dumbos, and homosexuals, grow up quickly. In fact, their growth is speeded by medical treatments that make necessary a new system of specifying ages. A by-the-calendar ten-year-old is eighteen in appearance and says he is eighteen-over-ten. And the meddling doesn't stop with adolescence. At marriage, each member of the community is kicked into middle age, and within a few years he or she is moved into senescence.

The meddling makes a certain amount of sense, for if everyone is to have as many kids as Laidlaw indicates, and if everyone lived as long as we do, the community would grow dreadfully overcrowded. Speeding up the life cycle gives everyone a chance and moves them along quickly to make room for the next generation. If it all smacks of corporate promotion policies, well, the enclave *is* run by a major corporation.

In this context, Laidlaw shows us Dad Johnson, a paranoiac bumbler obsessed with his rival and neighbor, Jock Smith, who has just mounted a missile launcher in his back yard. Dad's response is to put a mini-nuclear power plant in his garage, proving its safety by swallowing one of the fuel pellets, trusting that its special coating really will come off only in the reactor. (This gives Laidlaw the opportunity for his funniest passage, concerning Dad's ensuing "Mother of all belches.") He also orders a new daughter, gene-tailored to eat radioactive waste and excrete the remnants into her clinking diaper; she is an unlovable thing who snaps her teeth at anyone who approaches the reactor too closely. Then daughter Nancy falls for the Smith boy, they swipe some of the baby's clinkers to make a bomb, and the one-upmanship game gets serious.

So much might have made a delightfully pointed satire. Alas, it all falls apart when Laidlaw decides he must show the rest of the world. He has Dad's homosexual son, P.J., run away and become embroiled with religious zealots whose vengeful god apparently resides in a computer and yearns to wash P.J.'s brain clean enough to move in. It can also invade the enclave through its telework connections, once it learns of its existence, and P.J.'s escape saves no one. Nor does Mommy's sudden affair with a renegade corporate clone.

Laidlaw is a promising writer, but his best work is yet to come. Here, elegant social satire collapses into parody of action-adventure fiction, and the reader forgets his initial enchantment with Laidlaw's wry vision. Save your money for his next attempt, when he may have learned better control.

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Christopher Rowley's third novel, **Starhammer**, is not up to the standard of his first two (*The War for Eternity* and *The Black Ship*). It is pure action-adventure, nonstop, cliché-ridden, impossible.

Rowley posits human interstellar civilization built on NAFAL (Not As Fast As Light) ships. When the Testamenters, testing the first ftl ships, meet the older, more numerous, more advanced laowon, disaster follows. The laowon, with their culture of cruelty, quickly dominate the humans, relegating them to the role of slave race. *Starhammer* takes place a thousand years later, when ex-slave Jon Iehard is assigned to hunt down a terrorist but finds the terrorist is linked to a plan, hinging on the last surviving Testamenter ship and the remnant technology of a long-gone amphibian species, to throw off the laowon yoke. The story is one of hunt and chase, first as Jon pursues the terrorist, then, when the laowon capture and torture his assistant, as Jon frees her from the torturers, as the laowon pull out all the stops to catch Jon, as Jon and the terrorist flee in search of alien technology, as Jon and his new buddies play hide and seek with cannibal savages, as the laowon close in to seize the grail from their hands, and as Jon finally holds the button that can destroy worlds.

Nonstop action, poorly thought-out background, characters of thinnest cardboard. Will you forgive me if I suspect that Rowley wrote this one before *War* and *Ship*? There is none of the social and ecological intricacy that made those earlier books more than mere thud-and-blunder posturing.

Once upon a time, I knocked Suzette Haden Elgin for a touch of astronomical sloppiness in her Coyote Jones tales. Later, I praised her delightful trilogy. Now I have before me **Yonder Comes the Other End of Time**, in which the unlikely twain manage to meet. Responsible of Brightwater has let a stray thought slip free into the space between the stars, where it has caught the attention of the Communipaths, the telepathic communicators of the civilized galaxies. Since strong telepaths are a highly desirable commodity, and since unregistered telepaths are a definite no-no, the government sends Coyote Jones to investigate. He is to bring back the rogue telepath and/or recruit Ozark for the Federation.

Except that the Ozarkers don't want any. They have a perfectly good system of their own, thank you. It's based on magic, of course, which totally baffles and frustrates poor Coyote, and they don't feel much need for the Federation's assorted marvels. It doesn't help that Coyote, as the Federation's representative, impresses them as a bumbling, inept goof.

Elgin is trying to reconcile her own brand of fantasy with SF, and she isn't done; there are signs of at least one sequel to come. Unfortunately, it doesn't completely jell. Elgin fails to make Ozark's technology of magic fit a world of science and psience, despite some mumbling about faith. Too, Ozark is a serious world blessed with a pervading sense of gentle humor. Coyote's missions have serious grounds, but he himself is a jape—which produces a very different kind of humor—and he doesn't get on well at all on Ozark.

Yonder is a fun book, but we gain our greatest enjoyment when Elgin is focusing on Ozark. When Coyote is center stage, we are impatient for the author to quit the nonsense and get back to the real thing.

John Stith is a less elegant writer, and his **Memory Blank** is both less ambitious and less entertaining. His scene is two centuries hence, some years after an accidental plague has destroyed all

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human life on Earth. The species' remnants survive on Luna and in orbiting habitats, where guilt and despair have driven many to drugs and drink. Yet all hope is not dead. A generation-ship, the *Vittoria*, is about to depart for the stars, captained by the deeply religious explorer and computer expert, Russ Tolbor.

Into this context awakens protagonist Cal Donley, covered in blood, marked by massive bruises. What happened? He cannot recall. What's worse, he soon finds out that his memory has been erased in what he believes was an involuntary visit to a memory erasure clinic. Happily, the job wasn't perfect. Memory dribbles back, feelings, familiarities, dreads—including a strange sense that Russ Tolbor is not what he seems. There are clues in his computer's memory banks, villains chase him with toxic gases and bombs, and he seems to be all set for conviction as a murderer (all that blood, you know?).

But Cal struggles on, with the aid of a curious and trusting reporter and of his estranged wife. He is also helped by the villains' insistence—universal in melodrama—on not leaving well enough alone; their fear that his apparent recovery is more than it is leads them to hand him all the clues he needs. The outcome is predictable.

Less forgivable is the way Stith reveals his hole card far too early in the game. He would have had a better tale if he had left Cal's dreads formless until near the end. Unfortunately, he offers as a clue a reference to the Biblical tale of Sodom and Gomorrah, and we immediately know the disaster Cal must somehow forestall. Since it was predictable from the start that Cal would solve his mystery—heroes always win—the book depends for its suspense on the nature of the mystery. Stith's revelation makes the whole thing fall rather flat.

C.J. Cherryh is much better known for her novels than for her short fiction only because she has written many more novels. Her short stories and novelets are few and far between, though they too are excellent, as I have said in my reviews of past anthologies. Now, finally, she has written enough short stuff to fill a book, and she has been allowed to do just that. The book is **Visible Light**, and it contains the excellent "Cassandra," a tale of a girl the world thinks mad because she sees the future too vividly, and "Companions," of a man, left the sole survivor of his crew by a new planet's plague, whose ship proves too protective. The shorter "Threads of Time" is a sidelight from her early Ivrel novels; "The Last Tower" is a vignette written on a postcard for a convention; "A Thief in Korianth" is a gritty fantasy of underworld intrigue that seems ancestral to her recent *Angel with the Sword*. There is also a brand-new novelette, "The Brothers," which is a totally admirable exploration of the conflict between paradise and barbarism in that realm of faery that was ancient Ireland.

Cherryh sets her tales in an intriguing frame. She speaks to the reader, pretending that she and we are embarking on a voyage among the stars. She begins at dockside with a chance meeting, continues in the starship's lounge, and ends at debarkation. Her theme is the role and nature of the storyteller, and the tales of *Visible Light* are the examples she uses to prove her points. The result is a satisfying sense of the author as person and artist

Buy the book. You'll enjoy it. ■

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brass tacks

Dear Stan,

In the wake of the shuttle tragedy, I couldn't help but think of the exchange G. Harry Stine and I had in *Analog* a while back on how the news media would cover a shuttle disaster. Now, unfortunately, we have one, and it doesn't make me feel any better to say that I think the various news media outlets did a pretty good job in covering it—they did ask some hard questions, but none harder than the general public were asking.

Those of us in the news media may not be pro-NASA, but many of us are pro-space, as seen in how many journalists have signed up for the Journalist-In-Space Project, myself among them. If Stine plans to write anything about news coverage of the shuttle disaster, I'd be more than willing to comment from a news media angle.

Thanks, and condolences at this time of national mourning.

FRANK CATALANO

Dear Dr. Schmidt:

You must presently be considering some form of editorial comment upon last week's devastating loss of the *Challenger*. Enclosed is a copy of a column by Russell Baker published in the *New York Times* last Saturday, 2/1/86. No doubt you are fully aware of it already, but I enclose it anyway.

I guess President Reagan may possibly have set the stage for Baker's statement that "Most of us either forgot that flying on rocket power was dangerous or came to believe it wasn't." But when the President said something similar he was, in my opinion, attempting to assuage any collective sense of guilt we may feel because we weren't down on our knees praying when *Challenger* lifted from the pad. I can't fault the President for saying what he did—he

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was sharing grief and was most definitely including himself in. But I do fault Baker. In my view he was attempting to direct this sense of guilt to serve his own arguments—to attack "NASA and its PR policies."

I hold no torch for NASA. It has done, and is doing, many things with which I disagree. But I am relatively uninformed; and my adverse opinions concerning NASA need carry little weight—certainly I am not about to inflict them upon the world. Nevertheless, of one thing I feel sure: NASA is not—was not—in the business of deluding the public into believing that space flight is safe!

When Baker suggests that Christa McAuliffe went to her death deluded by NASA into imagining she was not at great risk, he does her no honor. Clearly he does not understand the intensity of Christa's belief that space is for Mankind—that it is our birthright. *But he knows she held these beliefs!* Many of those teachers who applied to fly in the shuttle were interviewed *after* the explosion. *Every single one* said they would go up in the next flight if they could.

Space isn't for test-pilots. It is *our* future. The right to lay one's life on the line for a belief in a cause belongs to all who would exercise it—not only to "professionals." When it comes to death, who among us can be considered an expert?

For that matter, why should Christa be regarded as an amateur? Did she not have a legitimate role to play? NASA's description of her was Mission *Specialist* if I remember me right. I suppose Russell Baker would argue that the title was one more ploy by NASA's PR brigade.

Christa, like every other astronaut who has flown or waits to fly, was—is—a HERO (forget gender). I suspect that the word faintly embarrasses Russell Baker; I suspect he regards it as a cliche. Perhaps there is an analogy between the clicheness of heroism and the routineness of space flight . . .

I repeat that it was Christa's credo that Man belongs in space; that it is our birthright. Knowing the risk full well, this wonderful woman laid her life on the line *for what she believed*, not for a mere "taste of excitement." There are no amateurs or professionals at this—only human beings, brave or otherwise. Space isn't for test pilots only—a world where only they should go until Baker's fine-drawn sensitivity lets him rule that the horror is no longer quite so "exquisite"; that it is all right now for amateurs to start to die.

I prefer to believe that Christa is to be *mourned* together with the other six astronauts, not pitied or patronized in the slightest. Our grief can be a clean one, unsullied by guilt, because Christa went with her eyes wide open, serving a noble cause (how about *that* for a cliche, RB?) doing what she wanted to do more than anything else in the world; she didn't *want* to die; she didn't *expect* to die; but she *was* prepared. Now we have lost her and I grieve. —I grieve for them all.

I pray that our space program (as much of it as remains these days) survives this tragedy and may the Russell Bakers of this world fail in their attempts to subvert Christa's death to its further vitiation.

GEORGE H. DOUGLAS

Malvern, PA

Dear Dr. Schmidt:

In his Alternate View column in the February '86 issue G. Harry Stine missed one of the better examples of the critical action time hypothesis, one that

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we truly couldn't live without. As you know, Heisenberg's Uncertainty Principle implies that any given quantity of energy will remain unaccounted for in a time interval whose duration is inversely proportional to the energy. Thus protons and neutrons can borrow energy, "working the float" on Heisenberg, to incarnate mesons, which they then exchange to manifest the strong force. The "illicit" profit that results from that system shenanigan is the existence of matter with atomic numbers greater than one. That's such an elegant example, I'm surprised Harry didn't mention it.

DENNIS ANTHONY

Los Angeles, CA

Dear Mr. Schmidt,

The last few years your science fact articles have tended to become rather "thin." "SUPERstrings" by Margaret Silbar (February 1986 issue) was a most welcome change.

In general, I think it is a mistake if you try to publish articles and stories that most of your readers will surely understand. Most of us prefer to be in a little bit over our heads.

Thank you for a bookcase full of pleasure.

JOHN R. DAY

Cupertino, CA

Dear Folks,

I greatly enjoy your fiction.

I just want to say that.

Also, I enjoy science fact.

However, I am not a trained physicist. To me a wave is something to surf on, a particle is anything around the size of a BB, and a quark, a little twist in life sometimes brought about by fate. Thus, I sometimes do not get the complete message of some of your science fact articles.

Take for instance the February '86 article, "SUPERstrings," by Margaret L. Silbar. There *must* be a prerequisite to it. Unfortunately, I have not taken those courses.

Now of course I know that a quark is something that is jammed into the necks of wine bottles to keep the wine in. But I would still like to see, at the end of each "fact" article, a brief glossary of the less common (to laymen of course) words as they apply to the context of the article.

Perhaps I am the only one who would appreciate this, but I like to think there are others.

PATRICK TADESHUK

Yonkers, NY

Such are the problems of trying to find a level that satisfies everybody! A glossary might be a good idea, but space often precludes. As an alternative, I might suggest reading the articles within reach of something like Van Nostrand's Scientific Encylopedia.

Dear Sir:

I've just read the February 1986 *Analog* (very nice, mostly) and I came across some replies to last July's editorial, which I generally agreed with. I was inspired to this by your last sentence in the magazine, part of an answer to one of your correspondents: "I'm a musician; my wife is not—and she very much wishes somebody had made her give it a try when she was growing up."

I think there are several interesting lines of thought which might be pursued from that statement, which tend to bear on your original editorial. The editorial did not include music as a recommended subject of study; it sort of intimated that nobody should be "made" to study something; and finally, it did not address the talent, or lack of same, which

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leads to passing or failing some particular course of education.

It would seem to be true that almost everyone can be taught mathematics up to the level of basic algebra, given a competent instructor. It is not obvious that everyone can be taught geometry, much less trig or calculus, since a certain *talent* for the necessary relationships seems to be necessary. Some students just grasp these things "intuitively," some get them with great difficulty, and some just don't. Of course, geometry to some is easy—it was to me—because it's visual, while "real" mathematics is tough, because it's not.

Most children can be taught to sing simple songs. Some will never be able to sing "rounds"—they get hopelessly confused—and many will never be able to master vocal harmony, while to others it comes "naturally." Even those who can sing may never master a musical instrument. That takes manual dexterity, as well as a musical "talent," and both must come together. At the same time, some who cannot master rounds or vocal harmony can become reasonably proficient at playing an instrument. I spent twenty years of weekends giggling around on keyboard and guitar, and I still get confused by rounds and vocal harmony.

Then there is the problem of what someone should be "made" to study. You recommend biology. I hated biology. I didn't like to kill and cut up small invertebrates to see how their insides work. I don't see any application to real life except for those who are going to become doctors, or paramedics, or, perhaps, butchers. In fairness, you pointed out the importance of ecology as a concomitant part of biology; I don't agree that the guts of an earthworm or a frog have anything to do with ecology. A point which you might have made, but didn't, is that a thorough understanding of genetics might let students make intelligent choices as to their mates, and the number, if any, of children they might bear.

At any rate, I was made to study biology. I now know virtually nothing of biology, *because* I hated it, and felt then, as now, that it had no relation to anything I wanted to do with my life. I also know people who, as children, were made to take piano lessons for years, and could not now play the Pepsi Cola jingle, melody and chords, if their lives depended on it. So much for *making* people study something.

I should think that such logic would also apply to exotic languages, and even to Shakespeare. (Perhaps particularly to Shakespeare. I suspect that more people would read the Bard's plays if they were "translated" to—i.e., written as—prose. The modern eye simply cannot relate to sentences broken up in arbitrary places on a page. Witness all the modern Bible translations, which get rid of the old "verse" form of the classic King James Version.) The sixties kids were the first in our age to put it bluntly: "What is not relevant can be relinquished." Perhaps this is shortsighted, as "those who do not know history are bound to repeat it," but supposedly knowledgeable kings, dictators, and presidents have been doing exactly that for millennia.

Enough of this. You're generally on target, but you have ignored the "talent" factor, and, to a lesser extent, the interest factors, and I think that there you err.

DOUGLAS MCGARRETT

Queens, NY

Forcing people to study things, especially for a long time, is admittedly risky. The danger of killing interest is why I still wouldn't recommend prolonged *compulsory studies. On the other hand, people may never suspect they* have *a talent until they try to do something which utilizes it. And it might never occur to them to try it unless*

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somebody makes them. You have to have at least a little exposure to a field —enough to know it exists and to get at least a vague idea of what it is—before you can know whether you're interested in it. That's why, since writing last July's editorial, I've become a little more favorably inclined toward requiring some brief introductory studies.

Dear Dr. Schmidt:

It's been some years since I was a regular reader of *Analog*, and, for that matter, it's been some years since I was a regular reader of science fiction. Other matters have been claiming most of my time.

But occasionally I do pick up an issue of *Analog* at the drugstore, and recently I noticed something in the February issue that I had to write a letter about. What I am talking about is your notion that educated people should learn a language that is not Indo-European, in order to be exposed to cultures and ways of thinking that are foreign to them. I don't have anything to say about the purpose behind your idea: in fact, I agree with it wholeheartedly. But I think that you are in the grip of a misconception if you believe that studying a language that is not Indo-European will automatically accomplish this purpose. The term "Indo-European" has nothing to do with culture. It is a linguistic classification only. There are languages which are not Indo-European that are spoken by people whose culture is the same as ours, and there are languages which are Indo-European that are spoken by people whose culture is very different from ours.

Consider three areas of the world: Europe, the Middle East, and India. There are four languages that are spoken on the continent of Europe, by peoples whose cultures are European, and yet are not in the Indo-European family of languages. These are Finnish, Estonian, Hungarian and Basque. The first three belong to the Finno-Ugric branch of the Uralic languages, and the last is apparently related to no other living language. In the Middle East there are three languages that have been and still are the principal vehicles of the common Islamic culture, and these are Turkish, Arabic, and Persian. Turkish is an Altaic language, Arabic is in the Semitic branch of Afro-Asiatic, and Persian is in the Iranian subdivision of the Indo-Iranian branch of the Indo-European family. In India, to a great extent, we have a common Hindu tradition that has been carried on in two unrelated groups of languages; the Indo-Aryan subdivision of the Indo-Iranian branch of the Indo-European family, and the Dravidian languages.

My point is that it is wildly wrong to equate linguistic relationships with cultural similarity. It may be easier to learn Hindi than it is to learn Finnish, but if anyone goes to Finland, he will find a way of looking at the world that is a lot closer to our way, than if he went to India.

FRED FOWLER

Atlanta, GA

Yes, it is wildly wrong to equate linguistic relationships with cultural similarity, which is why I didn't do it. My recommendations for studies of non-Western cultures and non-Indo-European languages were separate, though they could be satisfied jointly if you picked the right culture and language. But I'll stand by both. The justification for the language is not for the cultural content, but for fundamentally different ways *of formulating, organizing, and expressing ideas. I have trouble getting this across to many people educated here because they* haven't *been exposed to any fundamentally different ways, so they have no concept of what I'm talking about.* ■

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a calendar of analog upcoming events

28 August-1 September
CONFERDERATION (44th World Science Fiction Convention) at Atlanta, Georgia. Guest of Honor—Ray Bradbury, Fan Guest of Honor—Terry Carr, TM—Bob Shaw. Registration—$25 supporting until 15 July 1986; $65 until 15 July 1986, more at the door. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: ConFederation, Suite 1986, 3277 Roswell Road, Atlanta GA 30305.

19-21 September
MOSCON VIII (Idaho SF conference) at Cavanaugh's Motor Inn, Moscow, Idaho. Guest of Honor—Dean Ing, Artist Guest of Honor—Michael Goodwin, Fan Guest of Honor—Bryce Walden, Scientist Guest of Honor—Dr. Rob Quigley. Registration—$16 until 1 September, $18 thereafter. Info: MosCon VIII, Box 8521, Moscow ID 83843.

19-21 September
EARTHCON VI (Cleveland area SF/Fsy conference) at Holiday Inn, Cleveland, Ohio. Guest of Honor—Gordon R. Dickson, Special Guest of honor—C.J. Cherryh. Registration—$15 until 31 May 1986, $18 until 31 August 1986. Info: Earthcon, Box 5641, Cleveland OH 44101. Enclose S.A.S.E.

26-28 September
L & N DSC (DeepSouthCon 24: SF conference) at Galt House, Louisville, Ky. Guest of Honor—David Hartwell, Fan Guest of Honor—Ann Layman Chancellor, Featured Artist—Alex Schomberg, TM—Somtow Sucharitkul. Registration—$15 until 3 September 1986, $20 thereafter. Hucksters, Art Show, Masquerade, etc. Info: L&N DeepSouthCon, Box 58009, Louisville KY 40258.

27 August-2 September 1987
CONSPIRACY '87 (45th World Science Fiction Convention) at Metropole Hotel & Conference Centre, Brighton, U.K. Guest of Honor—Alfred Bester, Doris Lessing; Fan Guest of Honour—Joyce and Ken Slater; Artist Guest of Honour—Jim Burns Special Fan Guest—David Langford. Registration—Supporting L10, $15, $A20; This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: ConSpiracy '87, Box 43, Cambridge CB1 3JJ, England, U.K. OR Bill & Mary Burns, 23 Kensington Court, Hempstead NY 11550 OR Justin Achroyd, GPO Box 2708X, Melbourne, Vic. 3001 Australia.

3-6 September 1987
CACTUSCON (North American SF Conference) at Hilton, Hyatt Regency, Convention Center, Phoenix, Ariz. Guest of Honor—Hal Clement, Fan Guest of Honor—Marjii Ellers. Info: CactusCon, Box 27201, Tempe AZ 85282. (602) 968-5673.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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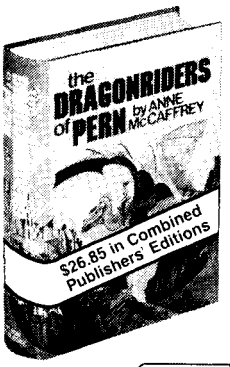

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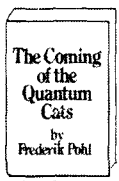

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